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UNIVERSITY OF PLYMOUTH

# ANTECEDENTS AND CONSEQUENCES OF OVERSHOOTING

# IN THE CONTEXT OF DISRUPTIVE INNOVATION

by

**YE ZHANG**

A thesis submitted to the University of Plymouth

in partial fulfilment for the degree of

**DOCTOR OF PHILOSOPHY**

Plymouth Business School

**November 2019**

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## Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Doctoral College Quality Sub-Committee.

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**Ye, Zhang**

# Abstract

Persistently improving certain performance characteristics of products, like functionality, reliability or usability, may make for difficulties in consuming those products, which is the situation of overshooting (Christensen, 1997; Chen, Reilly and Lynn, 2012; Lukas *et al.*, 2013). Overshot customers may consider products as too complex to use, too expensive to buy, too functionally advanced, or too good to have(Christensen, 1997; Thompson, Hamilton and Rust, 2005; Lukas *et al.*, 2013). Prior researchers take overshooting seriously for it may give opportunities to disruptive innovations from the low-end market of the overshooting products (Christensen, 1997; Schmidt and Druehl, 2008b; Hang, Garnsey and Ruan, 2015a; Christensen *et al.*, 2018).

However, it is against our common sense that people would be overshot by getting too much of a good thing. Many disruptive innovations' successful disruption over incumbent products, like microscope surgery's disruption over traditional surgery, are not because incumbent products are too good for customers (Klenner, Hüsig and Dowling, 2013; King and Baatartogtokh, 2015; Zhang, 2015). Moreover, people with intensive demand on certain product performances, like high-end customers, should be hardly satiated by product performance improvement. However, high-end disruptions are still existent and consequent to

incumbent's overshooting on certain performance trajectories of product (Christensen, 2006). This research is thus motivated by those confusing issues to rediscover the mechanisms of overshooting, its antecedents and consequent disruptive mechanisms, and suggest about the coping strategies to overshooting.

To achieve the research aims, a longitudinal case study with embedded units of analysis is resorted as natural experiment about an incumbent company and its interactions with three rival disruptors in the higher education market for learning management system. Prior theories and deductive themes are triangulated with the emergent patterns from case data to arrive at a more realistic perceptions towards the problem of overshooting. Also, the theory of path dependence process (Schreyogg and Sydow, 2011) as the underlying mechanism and structure of overshooting will act as the theoretical lens to make sense of overshooting process and its consequent disruption.

This research further clarifies from demand perspective that overshooting is decomposable into two dimensions which are 'compromised performance' and 'nonabsorbable performance'. The two dimensions of overshooting may lead to trade-off-reversing disruption and trade-off-breaking disruption as consequences. Also, this research further reveals from supply perspective that there are three different antecedents prior to three different forms of overshooting and consequent disruptions throughout the three-staged overshooting process of a path-dependent organisation (Schreyogg and Sydow, 2011). The coping strategies to overshooting are suggested to vary according to the different stages of overshooting process and the decomposed dimensions of overshooting. Both the demand and supply levels of analysis regarding overshooting and disruption corroborate with each other to arrive at a more holistic and validified reality regarding overshooting as well as its shaping process and consequent disruptive mechanisms.

# Table of Contents:


*1. CHAPTER ONE: INTRODUCTION ..... 12*

**1.1. Introduction ..... 12**

**1.2. Research Motivation ..... 12**

**1.3. Research Questions & Objectives ..... 16**

**1.4. Investigation through LMS Industry ..... 23**

**1.5. Methodological Brief ..... 25**

**1.6. Thesis Structure ..... 27**

*2. CHAPTER TWO: LITERATURE REVIEW ..... 29*

**2.1. Introduction ..... 29**

**2.2. Decomposed Overshooting ..... 29**

2.2.1. Overshooting in the Context of Disruptive Innovation ..... 29

2.2.2. Overprovided or Compromised Performance as Overshooting ..... 31

**2.3. Consequences of Overshooting ..... 37**

2.3.1. The Negative Consequences of Overshooting ..... 38

2.3.2. The Positive Consequences of Overshooting ..... 44

**2.4. Coping with Overshooting ..... 53**

**2.5. Antecedents of Overshooting ..... 57**

2.5.1. Antecedents of Overshooting & Persistent Improvement ..... 57

2.5.2. Persistent Improvement as Path-dependent behaviours ..... 61

2.5.3. Three Underlying Mechanisms of Persistent Improvement ..... 64

2.5.4. Ascertain Overshooting via the Theoretical Lens of Path Dependence Process ..... 71

**2.6. Overshooting & LMS Industry ..... 74**

2.6.1. LMS in the Higher Education Sector ..... 74

2.6.2. LMS Industry from Overshooting Perspective ..... 76

**2.7. Conclusion ..... 79**

*3. CHAPTER THREE: METHODOLOGY ..... 83*

**3.1. Introduction ..... 83**

**3.2. Research Philosophy ..... 83**

**3.3. Research Design & Justification ..... 87**

**3.4. Sampling Strategy ..... 93**

**3.5. Data Generation ..... 99**

**3.6. Data Analysis ..... 107**

**3.7. Data Saturation ..... 112**

**3.8. Ethical Consideration ..... 113**

**3.9. Conclusion ..... 114**

***4. CHAPTER FOUR: ANALYSES AND RESULTS ..... 116***

**4.1. Introduction ..... 116**

**4.2. Within-case Analyses ..... 118**

4.2.1. Blackboard Case ..... 118

4.2.2. Moodle Case ..... 136

4.2.3. Canvas Case ..... 149

4.2.4. Desire2Learn Case ..... 161

**4.3. Cross-case Analyses ..... 168**

4.3.1. Overshooting Associated with Meta-routine Mechanism ..... 169

4.3.2. Overshooting Associated with Self-reinforcement Mechanism ..... 186

4.3.3. Overshooting Associated with Lock-in Mechanism ..... 206

**4.4. Conclusion ..... 217**

***5. CHAPTER FIVE: DISCUSSION OF FINDINGS ..... 219***

**5.1. Introduction ..... 219**

**5.2. Discussion of Findings & Theoretical Patterns ..... 220**

5.2.1. Antecedent and Consequence of Mission Prioritization Overshooting ..... 220

5.2.2. Antecedent and Consequence of Market Penetration Overshooting ..... 228

5.2.3. Antecedent and Consequence of Misfit Overshooting ..... 234

**5.3. Discussion in a Wider Context of Literature ..... 242**

**5.4. Conclusion ..... 255**

***6. CHAPTER SIX: CONCLUSIONS ..... 258***

**6.1. Introduction……258**

**6.2. Theoretical Contributions ……258**

**6.3. Managerial Implications ……271**

6.3.1. Solving Innovator's Dilemma…… 271

6.3.2. Overcoming Incumbent's Inertia……273

6.3.3. Making Disruptive Innovation……275

**6.4. Best LMS for Higher Education Institution……. ……280**

**6.5. Research Limitations……282**

**6.6. Future Research Directions ……284**

***7. References …… 286***

***8. Appendices …… 343***

**8.1. Interview Transcripts……343**

**8.2. Interview Guides……438**

# Table of Figures:

***Figure 1: Three Underlying Mechanisms of Path Dependence Process…… 62***

***Figure 2: Theoretical Lens, Prior Theories and Deductive Themes as Preconceptions …… 82***

***Figure 3: Research Methods……88***

***Figure 4: The Shaping Process of Blackboard's Overshooting on Functions and Features 135***

***Figure 5: Moodle's Disruptive Process Consequent to Blackboard's Overshooting 148***

***Figure 6: Canvas' Disruptive Process Consequent to Blackboard's Overshooting ..160***

***Figure 7: Desire2Learn's Disruptive Process Consequent to Blackboard's Overshooting……166***

# Table of Tables:

*TABLE 1: Dual Mechanisms of Overshooting .....34*

*TABLE 2: Decomposed Overshooting and Consequent Disruptions.....42*

*TABLE 3: Literature Overview: Positive Consequences of Overshooting .....45*

*TABLE 4: Strategies Coping with Overshooting.....53*

*TABLE 5: Persistent Improvement Based on the Mechanisms of Path Dependence Process.....64*

*TABLE 6: Secondary Database Composition.....100-102*

*TABLE 7: Interviewees' Backgrounds.....103*

*TABLE 8: Analytical Process and Data Source .....117*

*TABLE 9: Blackboard, Inc.'s Growth Strategy and Market Expansion .....121*

*TABLE 10: Blackboard, Inc.'s Increasing Propensity for External Innovation.....126-129*

*TABLE 11: Antecedents and Consequences of the Overshooting Associated with Meta-Routine Mechanism .....171-173*

*TABLE 12: Antecedents and Consequences of the Overshooting Associated with Self-reinforcement Mechanism .....188-190*

*TABLE 13: Antecedents and Consequences of the Overshooting Associated with Lock-in Mechanism .....207-208*

*TABLE 14: Antecedents and Consequences of Overshooting throughout Path Dependence Process .....219*

*TABLE 15: Theoretical Contributions to Research Questions.....259-261*

## List of Abbreviations:

| Abbreviation | Full Form |
|---|---|
| LMS | Learning Management System |
| SaaS | Software as a Service |
| MOOC | Massive Open Online Course |
| AI | Artificial Intelligence |
| OS | Operational System |
| D2L | Desire2Learn |
| PC | Personal Computer |

# 1. CHAPTER ONE: INTRODUCTION

## 1.1. Introduction

It is human nature to desire for the better and more. However, researchers claim that people are sometimes overshot by more and better product performance (Thompson, Hamilton and Rust, 2005; Lukas *et al.*, 2013). The paradox puts managers in the dilemma of going further to improve product performances or not (Christensen, 1997). For the sake of addressing the dilemma, this introductory chapter will be motivated to look at the phenomena of overshooting and then to reveal the limitation of extant concepts and/or theories in the prior researches accounting for overshooting so as to narrow down from broad research questions to the specific research objectives of this research (Adner, 2002; Christensen, Verlinden and Westerman, 2002; Klenner, Hüsig and Dowling, 2013; Lukas *et al.*, 2013; King and Baatartogtokh, 2015). The methodology applied by this research to investigate the research questions will be briefed. At the end of this chapter, the overall structure of this research will be laid out.

## 1.2. Research Motivation

Product innovation is important for companies in developing and sustaining competitive advantage in fast-changing technological markets (Brown and Eisenhardt, 1995; Christensen, Clayton. Suárez, Fernando F. Utterback, 1998). Radical innovations may convey unprecedented benefits, markedly enhance product performance, reduce cost or open up new markets (Slater, Mohr and Sengupta, 2014; Joshi, 2016). However, radical innovation might well entail dynamic restructure of organisational competences to create new opportunity (Salomo, Gemünden and Leifer, 2007; Hang, Garnsey and Ruan, 2015a), risky exposure to new market (McNally, Cavusgil and Calantone, 2010), new technical competence or even new

ownership structure (Nagy, Schuessler and Dubinsky, 2016). Firms are thus more inclined to innovate by persistently improving certain well-established performance characteristics of product to retain customers and outcompete rivals, which drives firms to overshoot customers with the performance of those well-established product characteristics (Christensen, 1997; Lukas *et al.*, 2013).

The Japanese LED manufacturer – Sharp was the one excelling at constantly improving certain competitive performance metrics of product According to the report from CBNweekly (Fangqin, Ke and Tong, 2013), Sharp used to lead the global LED market for flat screen televisions by continuingly improving the accuracy and precision of their LED screens. However, when the accuracy and precision of LED displays overshot the needs of most consumers who then switched their attention to alternative attributes of TV like smart control and 3D display. Overshooting screen accuracy and precision gave Samsung and other competitors the opportunity to rival Sharp based on the alternative attributes. As a result, the global market share of Sharp LED plummeted from 20% in 2005 to only 6.9% in mainland China in 2012. Nevertheless, the reduced market share for LED flat screen televisions didn't condemn Sharp. The later booming demand on tablets and smartphone asked for screens with even higher precision, which restored the market performance of Sharp LED.

The case of Sharp highlights the situation of overshooting. In Christensen's book (Christensen, 1997 p.144), he explains the 'performance oversupply' as "*technologists were able to provide rates of performance improvement that have exceeded the rates of performance improvement that the market has needed or was able to absorb*". Notably, there are two categories of overshot customers: firstly, certain customers are not in the actual need of that much performance and overshooting happens as customers get more than they need (Lukas *et al.*, 2013); secondly, customers are having difficulties to absorb that much product performance even they might well still need it in certain circumstances (Earl and Potts, 2012).

However, subsequent researches tend to associate overshooting more with the first category of overshot customers while neglect the second one (Adner, 2002; Christensen, Verlinden and Westerman, 2002; Klenner, Hüsig and Dowling, 2013; Lukas *et al.*, 2013; King and Baatartogtokh, 2015). While the Sharp case is seemingly more associated with the first category of overshot customers, the second category of overshot customers are commonplace in product markets. Christensen and Raynor (2003) evidence that persistently improving certain product attributes may overprovide the performance of the particular attributes for the consumer and boost prices for features unwanted by customers. Thompson, Hamilton, & Rust (2005) suggests that constantly incorporating too many product features may cause user fatigue. Too speedy product development can be meaningless for customers due to the product quality compromised by fast time-to-market (Chen, Reilly and Lynn, 2012). Moreover, an excessive emphasis on ergonomics may restrict the flexibility of product usage (Yoo, 2004). In those circumstances, product price, usability and usage flexibility adversely affect customers' capacity of absorbing the ever-improving performance in product attributes, features and ergonomics.

In spite of the difference between the two categories of overshooting on customers, both of them share in common that improving certain performance characteristics of product precedes overshooting on customers. Also, both categories of overshot customers find themselves hard to consume the overshooting products. Given their similarities in phenomenon, it is no wonder why the second category of overshooting is often confounded with the first one, particularly in the studies linking overshooting to the theory of disruptive innovation (Adner, 2002; Christensen, Verlinden and Westerman, 2002; Klenner, Hüsig and Dowling, 2013; Lukas *et al.*, 2013; King and Baatartogtokh, 2015). The result is the poor predictability of overshooting as a precondition of disruptive innovation (Sood and Tellis, 2010; Klenner, Hüsig and Dowling, 2013; King and Baatartogtokh, 2015; Guo *et al.*, 2019).

This research proposes that the failure to differentiate between the two different categories or dimensions of overshooting on customers may cause difficulties in understanding overshooting and its consequent phenomena – disruptive innovation. This research will show how the decomposed dimensions of overshooting on customers can be particularly important when exploring the role of performance improvement of incumbent product relative to disruptive innovation. **The second dimension of overshooting indicates companies improve certain performance characteristics of products to the extent of adversely affecting customers' capacity to absorb the improved performance even which are very much needed by the customers.** Like the first dimension of overshooting, the second dimension of overshooting is very often to occur when certain trajectories of product performance are persistently pursued by firms. However, there are missing theoretical links between the improvement on product performance, the second category of overshooting and consequent disruption to motivate this research.

On another side, the antecedent of overshooting – the improvement on certain performance characteristics of product can be a justifiable innovation strategy in many circumstances. Firstly, constantly using the same innovation approach to improve certain performance metrics of product may foster the fit among different organizational activities and consolidate strategic position (Porter, 1996; Siggelkow, 2002; Olson, Slater and Hult, 2005). Secondly, persistently adopting the same approach of product innovation simplifies innovation space, which avoids the detour of seeking for alternative approach and proves to be effective in linear environment (Miller, 1993; Gilbert, 2005). Finally, although overshooting may cause adverse reaction from customers, the adversity could be temporary, tomorrow's customers may value the 'overshooting' in a different way. For example, artists can be inspired by some overly creative artistic work to produce a more evolved genre of art that might well be appreciated by customers in the future (Earl and Potts, 2013).

The pros and cons of improving the performance characteristics of products bring up the managerial problem about when it will give rise to overshooting? Once overshooting happens, firms displease customers, lose strategic flexibility and incur encroachment or even disruption from competitors (Sanchez, 1995; Christensen, 1997; Christensen, 2006a; Han, Chung and Sohn, 2009; Van Orden, van der Rhee and Schmidt, 2011; Earl and Potts, 2012; Klenner, Hüsig and Dowling, 2013; Lukas *et al.*, 2013). However, it is safe and necessary for firms to constantly hone their products in the same manner so as to achieve fit among internal activities, consolidate competitive position and gain market success in certain market environments (Porter, 1996; Siggelkow *et al.*, 2001; Siggelkow, 2002; Gilbert, 2005; Olson, Slater and Hult, 2005; Serge A Rijsdijk, Langerak and Jan Hultink, 2011). If the managerial dilemma remains unsolved, managers are always in the hesitation of going further to improve certain product performance metrics or not (Christensen, 1997). To resolved the dilemma, the antecedent of overshooting, improvement on certain performance characteristics of product, needs to be studied to clarify its relationship with overshooting.

### 1.3. Research Questions & Objectives

The following displays the broad research questions related to the topic of this research and the specific research objectives to be achieved so as to address the broad research questions:

**1. What is overshooting?**

- *To rediscover the mechanism of oversupplied performance as overshooting;*
- *To rediscover the mechanism of nonabsorbable performance as overshooting;*
- *To discover the different mechanisms of overshooting throughout overshooting process;*

**2. How and why overshooting is caused?**

- *To ascertain the different antecedents of the decomposed dimensions of overshooting;*
- *To discover the antecedents of overshooting throughout incumbent's overshooting process;*

**3. How and why does overshooting bring about disruption?**

- *To discover the disruptive mechanisms consequent to the decomposed dimensions of overshooting in the low-end/new markets and mainstream markets of incumbents;*
- *To discover disruptor's innovation mechanism throughout incumbent's overshooting process;*

**4. How do companies cope with the consequences of overshooting?**

- *To suggest the coping strategies to the decomposed dimensions of overshooting;*
- *To suggest the coping strategies throughout incumbent's overshooting process.*

As discussed in the last section, overshooting is initially defined as either 'oversupplied performance' or 'nonabsorbable performance' (Christensen, 1997). Nevertheless, the oversupplied performance definition is subject to anomalies (Danneels, 2004; King and Baatartogtokh, 2015; Guo *et al.*, 2019). The reason for it is because 'oversupplied performance' is in itself against human nature that people always desire for the better and more (Thompson, Hamilton and Rust, 2005; Lukas *et al.*, 2013). If so, why would customers be overshot by the better and more?

Certain studies propose that the improvement on some performance metrics of product may trade off or compromise other performance metrics (Hauser, 2001; Thompson, Hamilton and

Rust, 2005; Adner and Zemsky, 2006; Jacobs and Swink, 2011; Wan, Williamson and Yin, 2015), so the compromised or traded off performance characteristics may actually be factors causing overshooting. However, researches are yet to document how compromised performance is related to oversupplied performance to cause overshooting, so the current definition of oversupplied performance as overshooting is incomplete (Christensen *et al.*, 2018).

Scholars attempting to resolve the innovator's dilemma suggest that overshooting is the oversupply of the product performance characteristics not actually needed by low-end or new markets, which is sequenced by low-end and new-market disruptive innovations with good enough supply of mainstream performance characteristics but better supply of alternative performance characteristics attractive to low-end and new markets (Christensen, 1997; Adner, 2002; Christensen, Anthony and Roth, 2004; Govindarajan, Kopalle and Danneels, 2011). However, evidences have demonstrated that disruption is not necessarily consequent to the oversupply of the product performance unneeded by its mainstream consumers (King and Baatartogtokh, 2015; Zhang, 2015). Conversely, disruptions sometimes happen through products performing better than the performance characteristics constantly improved by incumbent products, such as smartphone's disruption over featured phone with more features or Uber's disruption over taxi companies with better convenience (Rhee, Schmidt and Van Orden, 2012; Christensen, Raynor and Mcdonald, 2016).

The contradictory evidences imply that the consideration of the oversupply of unneeded performance as overshooting could be incomplete. In other words, although the innovations improving certain performance trajectories of products are often related to disruption (Christensen, 1997), it does not necessarily work through 'oversupply of unneeded performance' to bring about overshot customers who would consider the product as "*overengineered, difficult to fully utilize, difficult to understand, or simply not ideal*" (Lukas *et al.*, 2013). Therefore, the contradiction in the last paragraph imply that the failure to reveal the

mechanisms through which overshooting gives rise to disruption. By failing to articulate the mechanism, the "unneeded performance oversupply – overshooting – disruption" framework are subject to anomalies (Danneels, 2004; Christensen, 2006b; King and Baatartogtokh, 2015) and the question about how and why overshooting brings about disruption from low-end and new market remains incompletely solved by prior researches (Christensen *et al.*, 2018; Guo *et al.*, 2019).

On another side, 'nonabsorbable performance' remains a largely ambiguous concept. Previous researchers contend that high-end or mainstream customers with intensive demand on certain product performances are overshot by 'performance overconcentration' (Adner, 2002; Christensen *et al.*, 2018). Performance overconcentration suggests that performance improvement can be overconcentrated on certain product characteristics or dimensions intensively needed by the high-end or mainstream customers, so the overconcentrated performance can be combined with other performance characteristics or dimensions of product to provide more product utilities, which alleviates the overconcentrated performance as overshooting (Adner, 2002; Wessel and Christensen, 2012).

The provision of performance dimensions alternative to the overconcentrated performance dimension of a product may give extra capacity to customers to absorb the product. There is diminishing utility generated from the overconcentration on the improvement of limited performance dimensions of product, so customers may find overly concentrated performance improvement increasingly nonabsorbable due to the diminishing utility (Adner, 2002). For example, the high-end hotel customers may find it increasingly difficult to absorb more of the luxury dimension of hotel due to diminishing utility unless the price dimension of hotel could be lower. However, high-end customers do not necessarily care so much about the price dimension of luxury hotel, so the mechanism remains unclear about why high-end or mainstream stream customers suddenly find product more absorbable by combining the

overconcentrated performance dimension of product with other performance dimensions of product that they do not need as much? This research will also clarify what is overshooting by rediscovering the mechanism of nonabsorbable performance as overshooting.

The questionable relationship between overshooting and disruption also brings up another researchable objectives about mechanisms through which overshooting brings about disruption in the mainstream or high-end markets of incumbent? As incumbent keeps overshooting certain performance trajectories or characteristics of product, disruptive innovation can encroach into the mainstream or high-end markets of incumbent (Christensen, 1997). However, the encroachment mechanism remains controversial (Christensen, 2006a). The initial explanation towards the encroachment mechanism is that overshooting product is overconcentrated on certain performance characteristics of product, which leaves out opportunity for disruptive innovation to improve and combine alternative performance characteristics with the overconcentrated performance characteristics to offer a wider range of performance characteristics (Christensen, 1997). However, researcher later realises that mainstream or high-end customers are with intensive demand on the overconcentrated performance characteristics, so it is strange that mainstream or high-end customers would demand or care about the alternative performance characteristics (Adner, 2002).

One notable observation is that high-end disruption is preconditioned by the combination of higher performance of the product characteristics appealing to mainstream market and the weak, intermediate or strong performance of the product characteristics attractive to fringe or new market (Rhee, Schmidt and Van Orden, 2012). This observation is contradictory with recent researches that disruption will not encroach into the mainstream or high-end market unless it could break the trade-off between and improve the performance characteristics appealing to both mainstream market and markets peripheral to mainstream market, like low-end and new market, to the same level (Wessel and Christensen, 2012; Christensen *et al.*, 2018). The

contradictory observation implies that the relationship between the overshooting performance characteristics of product appealing to mainstream market and the performance characteristics attractive to markets peripheral to mainstream market need to be ascertained so as to explain how and why overshooting gives rise to disruption in the high-end or mainstream market of incumbent product.

Moreover, certain researchers interested in disruptive innovation have observed that disruptors need to be ambidextrous at both the overshooting product performance dimensions and disruptive performance dimensions so as to encroach upwards into the high-end market of incumbent product (O'Reilly and Tushman, 2008; Wessel and Christensen, 2012; Christensen *et al.*, 2018). However, the mechanisms through which the disruptor become ambidextrous remains underexplored. Although it is clear that incumbent company can be held back by its embedded competence to develop ambidexterity (Christensen and Bower, 1995; Gilbert, 2005; Henderson, 2006; Vecchiato, 2017), it is yet sufficiently discussed about mechanisms through which disruptors able to develop the ambidexterity and gain advantages over incumbent's overshooting product (O'Reilly and Tushman, 2008). As a result, the mechanism through which overshooting leads to disruption still needs the patch about disruptor's ambidexterity development.

Apart from the overshooting itself and its consequent disruption, prior researches also investigate into the antecedent causes of overshooting. However, the previously documented antecedents of overshooting are contingency-based on varied organizational, market or value network factors (Rebecca and Kim, 1990; Christensen and Bower, 1995; Leonard-barton, 1998; Narver, Slater and MacLachlan, 2004; Thompson, Hamilton and Rust, 2005; Sterman *et al.*, 2007; Earl and Potts, 2012; Lukas *et al.*, 2013; Christensen *et al.*, 2018). Given the varied causes of overshooting, companies are theoretically confronted with the intricacy of sorting out which one is the more underlying antecedent of overshooting and which antecedent is more

salient than others in raising overshooting over time? This research will set research objectives as a response to those research questions by scrutinizing the antecedents of overshooting at different phrase of overshooting process in a longitudinal case study (Ozcan, Han and Graebner, 2017). The objective is to discover the antecedents of overshooting throughout incumbent's overshooting process.

Also, as previous researches fail to differentiate the decomposed dimensions of overshooting (Christensen, 1997; King and Baatartogtokh, 2015; Christensen *et al.*, 2018; Guo *et al.*, 2019), the antecedents of overshooting documented so far are not actually matched with the right dimension or form of overshooting (Christensen and Bower, 1995; Narver, Slater and MacLachlan, 2004; Noda and Bower, 2007; Earl and Potts, 2012; Lukas *et al.*, 2013; Vecchiato, 2017). Therefore, this research will fill this gap by matching the right antecedents of overshooting to the right dimension or form of overshooting. By doing so, how and why overshooting is caused can be more elaborately answered.

Once the nature and context of overshooting is investigated, this research will make suggestions about how to cope with overshooting? previously suggested coping strategies with overshooting can be divided into three streams which are market-oriented coping strategies (Christensen, 1997; Adner and Snow, 2010; Wessel and Christensen, 2012; Raffaelli, 2018), organisation-centred coping strategies (Tripsas and Gavetti, 2000; Henderson, 2006; Thrane, Blaabjerg and Møller, 2010; Yu and Hang, 2010; Lukas *et al.*, 2013), and value-network-based coping strategies (Adner and Kapoor, 2010; Parry and Kawakami, 2017; Roy and Cohen, 2017). Again, without the further elaboration on different dimensions of overshooting and different antecedents of overshooting over time, the coping strategies tend to be misexecuted and mistimed. This research will suggest the right matching between the different dimensions of overshooting and different antecedents of overshooting over time with their coping strategies.

## 1.4. Investigation through LMS Industry

This research manages to achieve research objectives through the case data from the LMS industry in the higher education sector of America, Britain and Canada. In the past two decades since 1997, the market leader of the higher education LMS (Learning Management System) market went through a process of becoming increasingly dominant in the higher education LMS market until the year of 2006 and then kept gradually losing its ground to rival LMS companies thereafter (Green, 2012; Dimeo, 2017; Feldstein, 2017a; Straumsheim, 2017). The trend manifests in the higher education sector of America, Britain and Canada (Edutechnica, 2018a; ListedTech, 2018). As the up and down of Blackboard LMS was largely due to its constant adding up to the number of LMS features, the LMS industry was selected to illustrate the shaping process and consequence of increasing the number of product features to the extent of overshooting (Thompson, Hamilton and Rust, 2005; Kelly, 2009).

By persistently improving the number of LMS features, Blackboard encountered the problems of both oversupplied performance and nonabsorbable performance as overshooting. Prior researches have evidenced that Blackboard outcompeted rival LMS – Moodle in terms of the number of LMS features but was eclipsed by Moodle's price and customizability (Zinn, 2010; Carvalho, Areal and Silva, 2011; Poulova, Simonova and Manenova, 2015). The trade-off between features numbers and price or customizability possibly discredit the prior definition of oversupplied performance as overshooting for the customers may switch from Blackboard to Moodle for lower price or better customizability but not purely because of too many features. The similar evidence also exist between Blackboard and its rival LMS – Desire2Learn (Lalande and Grewal, 2012), which makes it possible that customer may switch to Desire2Learn for its better simplicity but less feature sophistication (Lalande and Grewal, 2012). Therefore,

oversupplied performance in LMS features as overshooting will be subject to further investigation in this research.

On another side, both public and private surveys have showed that rival LMS encroached into both the high-end and mainstream markets of Blackboard LMS in the higher education sector (Green, 2010; Green, 2012; Edutechnica, 2018a; ListedTech, 2018). The high-end and mainstream market encroachment provide as a natural experiment to rediscover the nonabsorbable performance as overshooting. The high-end or mainstream markets of Blackboard tend to be with intensive demand on the number of LMS features but less demand on other performance characteristics like price, customizability or usability. However, rival LMS including Moodle, Canvas, Desire2Learn and others still successfully took market shares from the mainstream or high-end markets of Blackboard even which outperformed rival LMS for LMS features (McLeod, 2011; Raadt, 2012; UITS Learning Technologies Functional Requirements Committee, 2013; Rogers, 2014; Zanjani *et al.*, 2017; McKenzie, 2018). Obviously, those customers with intensive demand on feature sophistication should have not been overprovided by the feature-ridden Blackboard LMS, so their likely problem is hard to absorb the abundant features of Blackboard LMS even they need it. The LMS will thus provide as a natural experiment to discover the nonabsorbable mechanism by the high-end and mainstream customers of Blackboard even they need it.

As the decomposed dimensions of overshooting are revealed through the case data from LMS industry, the antecedents and consequences of overshooting can be ascertained through the longitudinal data regarding the interaction between Blackboard and major rival LMS. Blackboard has kept evidently losing ground to other rival LMS since 2006 to 2017 (Feldstein, 2017b; Lieberman, 2017; Straumsheim, 2017). The lengthy period of a decade can provide as a detailed process to exam the evolving effects of different antecedents of overshooting, the corresponding relationships between different antecedents and consequent disruptions with

different dimensions of overshooting. Moreover, the successful turnaround of Blackboard in recent years also shed lights on how could overshooting be coped. Therefore, the aforementioned research aims will be achieved through the case data from LMS industry in the higher education sector of America, Britain and Canada.

Understanding the nature of overshooting and its antecedents and consequences have tremendous importance for companies, like Blackboard, to hedge against disruption consequent to overshooting; also, for companies, like the rival LMS including Moodle or Canvas, to make disruptive innovation to take advantages of incumbent's overshooting. More importantly, understanding overshooting will also help overshooting companies, like Blackboard, to judge if its product has actually overshot customers or not as they consolidates their strategic position by constantly improving certain performance characteristics of products (Porter, 1996) and hence the innovator's dilemma of going further to improve certain performance dimensions of product or not can be resolved (Christensen and Raynor, 2003).

### 1.5. Methodological Brief

A longitudinal case study based on comparative logic will be selected to inspire and illustrate about the antecedents and consequences of overshooting in the context of disruptive innovation (Eisenhardt, 1991; Siggelkow, 2007a; Ozcan, Han and Graebner, 2017). Prior literatures are firstly reviewed to find out the underlying mechanisms driving firms to be persistently path-dependent on certain organisational practices (Schreyogg and Sydow, 2011). The path-dependent mechanisms will be used as theoretical lens to make sense of companies' constant improvement on certain performance characteristics of product, their likely relationships with overshooting as well as the consequent disruptions.

The different embedded units of analysis within the longitudinal case study of Blackboard and its interaction with three major rival disruptors in the learning management system market for higher education sector will serve as the natural experiments to see if there are missing theoretical links between product innovations improving certain performance trajectories and overshooting as well as how disruptions would follow up the rediscovered circumstances of overshooting (Ozcan, Han and Graebner, 2017). The different unit of analysis will confirm and disconfirm each other to add to the validity and reliability of the emergent patterns of theories (Eisenhardt, 1991; Yin, 2017).

Procedurally, all the concepts from literatures review will be used and deducted as preconception to make sense of case study (Eisenhardt, 1989). Afterwards, four independent case histories embodying persistent improvement, overshooting and disruption will be selected to demonstrate from demand perspective that there are anomalies to violate existing theories regarding the antecedents and consequences of overshooting, which provide as an opportunity to refine existing theories based on the theoretical implications of case study (Glaser and Strauss, 1967; Christensen, 2006a; Eisenhardt and Graebner, 2007; Siggelkow, 2007). The preconceptions based on prior literatures will be compared with the themes and relationships grounded on the case study. The comparison is, for one, to use preconception as sensors to data that might well be important for further theory elaboration and, for another, to use themes or relations emerged from data confirm or disconfirm preconception or grounded themes (Thrane, Blaabjerg and Møller, 2010; Hang, Garnsey and Ruan, 2015a). Moreover, a longitudinal case with different embedded unit of analyses will be compared with each other to generate theoretical patterns from supply perspective and further enhance the generalizability of the theoretical patterns emerged from the four independent within-case analysis (Eisenhardt, 1989; Eisenhardt, 1991; Yin, 2009).

## 1.6. Thesis Structure

Including this chapter, this thesis involves six chapters from introduction to conclusions. The core theoretical propositions will be developed in the chapter of Analyses and Results but finally presented in the chapter of Discussion of Findings. In the principle of grounded analysis (Strauss and Corbin, 1998), this research will initially present case studies in chronological order to let theoretical patterns naturally emerge in the with-case analysis section of the chapter of results and findings. In the cross-case analysis section of the results and findings chapter, the naturally emerged pattern will be compared across different units of analysis and preconceptions to arrive at the core theoretical thrust of this research.

Moreover, the inductive nature of this research lies in the balanced perspectives of the data and theoretical positions of this research with prior researches, so this research will not follow the structure normally from those deductive researches to generate propositions and themes in the literature review and test them in the data analyses section. Instead, prior researches regarding overshooting are necessarily to be detailed and extended into this research early in the literature review as preconceptions to triangulate and integrated with the newly emerged themes and propositions later in the data analysis of this research to produce theoretical outcome. Therefore, the final theoretical framework will vary substantially from but triangulate with the preconception framework based on literature review.

However, like deductive researches, the originality of the theoretical contribution needs to be explicit and significant. Therefore, this research will emphasize and discuss the contribution of this research in a wider background in the chapter of the discussion of findings (Dunleavy, 2003). The following summarize the key points of each chapters:

- Chapter 2 – Literature Review: this chapter will review prior literatures as prior theories,

theoretical lens and deductive themes which are used later as preconceptions to be triangluated with the emergent patterns grounded on the case data of this research.

- Chapter 3 – Methodology: this chapter will expound the philosophical assumptions, research design, data collection, data source and ethical consideration of this research.

- Chapter 4 – Analyses and Results: within-case analysis will be conducted to let theoretical patterns naturally emerge, confirm and disconfirm certain preconceptions developed from literature review. cross-case analysis will be conducted to generate repeatable theoretical patterns across units of analysis. The repeatable theoretical patterns will be compared with the patterns or themes emergent from with-case analysis to arrive at the theoretical positions regarding the antecedents and consequences of overshooting in the final analysis.

- Chapter 5 – Discussion of Findings: the theoretical patterns emergent from data analysis will be discussed with other relevant literatures. Also, the patterns based on with-case analysis and cross-case analysis will be compared with each other to achieve more robust theoretical triangulation for one and enrich the context of the emergent theoretical pattern for another. Finally, the emergent theories will be discussed in a wider context of literature.

- Chapter 6 – Conclusions: this chapter will summarize the discoveries of this research in terms of their theoretical contributions, managerial implications and practical implication in the higher education sector. At the end of the chapter, the limitations and future directions of this research will be discussed.

# 2. CHAPTER TWO: LITERATURE REVIEW

## 2.1. Introduction

Prior literatures are of paramount importance for this research, the reason, for one, is because prior literatures do not only provide as intellectual foundation upon which further discoveries can be made but also as prior perceptions of truth to be balanced with the perception of this research. On that ground, prior theories regarding overshooting as well as its consequent disruptive innovation are reviewed in the contents immediately following this introduction. Additionally, prior theories concerned with the underlying mechanism and structure of research questions can be deducted and then used as the theoretical lens to induct with case studies for theory development (Thrane, Blaabjerg and Møller, 2010; Hang, Garnsey and Ruan, 2015a). Therefore, the later part of this chapter will be about the theoretical lens taken on to ascertain the antecedents of overshooting.

## 2.2. Decomposed Overshooting

Scholars are likely to inaccurately conceptualize overshooting as the overprovision of product performance unneeded by customers (Lukas *et al.*, 2013; King and Baatartogtokh, 2015), which stresses the importance of better interpreting the construct of overshooting. In this section, overshooting will be decomposed into two dimensions which are 'compromised and nonabsorbable' performance characteristics of product. The decomposition into the two dimensions of overshooting helps to better explain the disruptions consequent to overshooting.

### 2.2.1. Overshooting in the Context of Disruptive Innovation

Overshooting is a term with negative intonations, so prior researches often stress the negative repercussions of overshooting. For instances: excessive improvement of product variety may delay the buying decisions of customers (Mitchell & Papavassiliou, 1999); excessive

consideration for the convenience of product usage may restrict the reflexivity and creativity of users (Yoo, 2004); persistent improvement on the multi-functionality of products can cause usability fatigue (Thompson, Hamilton and Rust, 2005); constant improvement of product capability may render the product excessively capable and unnecessarily wanted by customers (Lukas *et al.*, 2013).

However, overshooting still brings benefits to organisations or markets. For example, although improving speed-to-market may undermine product quality (Hauser 2001), there are still evidences that faster speed-to-market can improve product profitability (Stanko, Molina-Castillo, & Munuera-Aleman, 2012). Four Season's Hotel may overshoot low-end customers but serve well for high-end ones (Wessel and Christensen, 2012). The contradictory results are possibly due to the heterogeneity of market demand (Adner and Levinthal, 2001; Adner, 2002; Adner and Snow, 2010). As a result, persistently improving certain product attributes may overshoot certain customers while please others. Overshooting is something inevitable as long as personal preferences in a market are not unified as one, so companies should avoid overshooting their targeted market segments.

As every new product is kind of overshooting, overshooting is only considered as a serious problem when it brings up repercussions over a wider audience of a company. Christensen takes overshooting seriously for it acts as important cause of disruptive innovation (Christensen, 1997; Christensen, 1997; Christensen *et al.*, 2018). In his book (Christensen and Raynor, 2003 p.223), overshooting is defined as "*providing more performance than consumers can use". "Overshot customers are those for whom existing products are more than good enough*" (Christensen, Anthony and Roth, 2004 p.3). When a portion of customers are overprovided with certain performance characteristics of a product, the portion of customers may switch to disruptive innovations with just enough performance for those characteristics but better performance on other product characteristics (Christensen, 2006a; Govindarajan, Kopalle and

Danneels, 2011). As time goes by, the disruptive innovations will improve the good enough performance characteristics to more than enough, which enables disruption over the product previously overshooting customers (Christensen, Raynor and McDonald, 2015).

Given the relationship between overshooting and disruption, avoiding overshooting in companies' mainstream market are far from enough. In the low-end market or new market peripheral to the mainstream market of a company, customers are most likely to be overshot and thus switch to rival products. The switched customers will feed the low-end and new-market disruptive innovations to endanger the mainstream market of incumbent companies (Christensen, 2006a; Christensen *et al.*, 2018).

However, hedging against overshooting in every low-end or new market may not be worthwhile. After all, rival products encroaching into the low-end or new market peripheral to the mainstream market of a company are not necessarily growing into full disruption (Tellis, 2006; Rhee, Schmidt and Van Orden, 2012). For example, low-end hotels might well be just content with offering low-end services and earn low margins based on huge volume of sales unless those low-end hotels are able to break the trade-off between price and quality and encroach upwards to high-end market of incumbent luxurious hotels (Wessel and Christensen, 2012; Christensen *et al.*, 2018). Otherwise, ignoring those low-end or new-market encroachment may be justifiable. Nevertheless, the trade-off puts the previous understanding of overshooting in question.

### 2.2.2. Overprovided, Compromised & Nonabsorbable Performances as Overshooting

According to Christensen's definition (Christensen and Raynor, 2003; Christensen, Anthony and Roth, 2004), overshooting is regarded as the oversupply of product performance. Previous researches concerned with overshooting are also inclined to investigate factors luring companies to improve product performance to the extent of overprovision (Christensen and

Bower, 1995; Thompson, Hamilton and Rust, 2005; Lukas *et al.*, 2013; Vecchiato, 2017). For examples, the explicit needs of targeted market segments by a company may "shape the allocation of resources in technological innovation" (Christensen & Bower, 1995 p.197) and drive companies to overly invest into the product attributes explicitly demanded by existing customers (Narver, Slater and MacLachlan, 2004). Also, companies may have the culture of being technologically cutting-edge or aggressively competitive, which makes for the overprovided performance of product (Lukas et al., 2013).

On another side, overshooting needs to be understood from market perspective for it is the customer who is overshot. From the market side, overshot customers are either not in the actual need of or limited in their capacity to absorb the performance improvement of product (Christensen, 1997). The former category of overshot customers get more than they want from product performance (Lukas *et al.*, 2013). For example, a TV remote panel could contain a lot of buttons and features unnecessary for people (Goldenberg and Horowitz, 2003). The overprovision of unneeded product performance also include the situation when the actual utility from using a product is diminishing (Adner, 2002). In that case, the improvement on product performance is made in diminishing proportion to the product benefits realized by customers.

However, overshooting product performance may not because of the overprovision of unneeded performance but because the improved performance characteristics of product adversely affect other performance characteristics needed by customers. Customers inside a market may have heterogenous needs on the varied performance characteristics of product and sometimes different performance characteristics are in trade-off with each other, like speed-to-market versus quality and multi-functionality versus simplicity (McNally, Akdeniz and Calantone, 2011; Burke, 2013). When firms allocate too many resources to improve certain product attributes at the expenses of improving other product attributes, the compromised

performance of product features can be displeasing for some other customers (Hauser, 2001; Burke, 2013). In those circumstances, the displeased customers are not because of the overprovided performance of unneeded product performance but the compromised provision of certain performance characteristics for the overprovision of other performance characteristics.

Although prior literatures rarely relate the trade-off between product performance characteristics to overshooting, it is still a phenomenon relevant to it (Earl and Potts, 2012; Wessel and Christensen, 2012; Christensen *et al.*, 2018). For example, an excessive emphasis on ergonomics may restrict the flexibility of product usage, which caused the failure of Apple's digital assistant product - Newton (Yoo, 2004). Here the ergonomic performance was the performance characteristic intended by Apple but which compromised usability as the turning point to lead to unintended market outcome. Likewise, a company may intendedly and persistently add new features to product so as to improve product utility. However, there is a turning point when product is overloaded with features to compromise the usability performance of the product (Thompson, Hamilton and Rust, 2005). Moreover, a company may constantly expand its product portfolio to the extent of exceeding customers' capacity to appropriately remember, compare and select from the wide array of offering (Jacobs and Swink, 2011). All those point at the existence of another form of overshooting – compromised provision of performance.

While researchers has discussed about the cause and effect between overprovision of product unneeded performance and disruption (Christensen, 1997; Adner, 2002; Schmidt and Druehl, 2008a; Guo *et al.*, 2019), evidences regarding the compromised performance as overshooting and its relationship with disruptive innovation are in the need of documentation. Otherwise, there are anomalies to existing 'unneeded performance overprovision-overshooting-disruption' theoretical framework (Christensen, 2006a). One notable anomaly is the disruption of

microscope surgery into the mainstream market of traditional surgery, no one would consider it as a good reasoning to say patients switched to microscope surgery are because traditional surgery is excessively good for patients in terms of curative effects (King and Baatartogtokh, 2015). Obviously, the compromised performances by traditional surgery including unintended damages are reasons for the disruption from microscope surgery. This research will thus broaden the current definition of overshooting by involving and emphasizing the circumstance of the compromised provision of product performance to account for the anomaly in question.

**Table 1: Dual Mechanisms of Overshooting**

| Overshooting | Related Researches | Examples |
|---|---|---|
| **Overprovided Performance** | (Christensen, 1997; Adner, 2002; Klenner, Hüsig and Dowling, 2013; Lukas *et al.*, 2013; King and Baatartogtokh, 2015; Guo *et al.*, 2019) | BMW 745 is with more than 700 dashboard features and many of the features are redundant (Thompson, Hamilton and Rust, 2005). |
| **Compromised Performance** | (Christensen, 1997; Hauser, 2001; Thompson, Hamilton and Rust, 2005; Jacobs and Swink, 2011; Earl and Potts, 2012; Burke, 2013) | The portability of Camera phone compromises its camera capability as the product class was initially developed (Han, Chung and Sohn, 2009) |

By seeing through prior researches (see Table 1), overshooting actually involves two mechanisms: one is that certain product attributes are persistently improved to the point of overproviding product performances that are not actually needed by the customers (Christensen, 1997; Christensen, 2006b; Han, Chung and Sohn, 2009; Lukas *et al.*, 2013). The overprovided improvement on certain product attributes will diminish customers' willingness to pay (Adner, 2002), make customers feel unnecessary and delay their purchase decisions due to too many product options (Mitchell and Papavassiliou, 1999; Mitchell, 2005; Leek and Kun, 2006), provide too many product features (Thompson, Hamilton and Rust, 2005; Han, Chung and Sohn, 2009) or create products which are too high-end (C. Christensen, 1997; Rhee, Schmidt and Van Orden, 2012; Lukas *et al.*, 2013).

Another mechanism of overshooting is that the improvement on certain product performances metrics must be compromised for the improvement on other performance metrics. For instance, in order to improve speed-to-market, product quality has to be sometimes compromised (McNally, Akdeniz and Calantone, 2011; Stanko, Molina-Castillo and Munuera-Aleman, 2012). Also, compromises intending to improve product functionality may have to compromise the improvement on the easiness of use (Burke, 2013). Nevertheless, the compromises may not be in the favour of some customers in a market with demand heterogeneity and hence overshot certain customers while please others (Slater and Mohr, 2006; Corrocher and Zirulia, 2010; Glen and Fournier, 2013).

However, the mechanism of overprovided performance may be incomplete due to its poor predictability of overshooting. For example, although unneeded product features may overwhelm low-end customers, the customers may simply enjoy or ignore the unneeded and oversupplied performance of product, which is at least better than switching to alternative products without oversupplied performance. Also, the mechanism of compromised performance needs further explanation about how it may give rise to overshooting. If there is trade-off between different product attributes, then every new product will compromise certain performance characteristics needed by others. However, the reality is some new products are overshooting customers while other do not. Therefore, this research will further elaborate how the mechanisms of oversupplied and compromised performance as overshooting interact with each other to give rise to overshooting.

Another dimension or category of overshot customers are limited in their absorptive capacity for product performance improvement. Absorptive capacity is the "*ability to recognize the value of new information, assimilate it, and apply it to commercial ends*" (Cohen and Levinthal, 1990 p.128). This term is extended to describe customers' ability to recognize, assimilate and apply the performance characteristics of product innovation into actual utility (Christensen,

1997). when customers are difficult to absorb or turn the improved performance characteristics of certain products into actual benefits, like functionality, the customers are considered as being overshot. Overshot customers would see products “difficult to fully utilize, difficult to understand, or simply not ideal” (Lukas et al., 2013 p.1).

However, there are rare researches articulating why the overshot customers find product performance nonabsorbable even they are in the need of the performance and the performance are also actually provided. One stream of customers is obviously with intensive need of certain product performances and companies are also eager to meet their needs. The stream of customers is high-end customers in different product markets. Oversupplied or compromised performance as overshooting does not apply for high-end customers for they are neither oversupplied by the performance characteristics that they intensively need nor compromised by the performance characteristics that they do not need as much.

Those high-end customers are still overshot and switched to disruptive innovation if a rival disruptive innovation can provide performance characteristics more than incumbent product. For example, a high-end luxury hotel guest may be overshot and switch to disruptive innovation – Airbnb as which breaks the trade-off between luxuries and price to offer both while traditional high-end hotel only offer luxuries (Christensen *et al.*, 2018). This rationale is also supported by another observation that the high-end customers for hard disk drives were overshot by the capacity of hard disk drives and switched to smaller-sized and cheaper hard disk drive for which can provide another performance characteristics needed by high-end customers - lower price (Adner, 2002).

Nevertheless, the two cases make for the question about why high-end customers with high affordability suddenly care so much about price in spite of their intensive demand on the core performance characteristics, like luxury or capacity, of product? May it be that high-end

customers are overshot not because of incumbent's overconcentration on its core performance characteristics but because of other mechanisms making product performance needed by them hardly absorbable? This research will thus shed lights on this area so as to clarify the scenario about overshooting that occurs to customers with intensive demand on certain product performances.

### 2.3. Consequences of Overshooting

In the past two decades, one of the consequences of overshooting – disruptive innovation has maintained controversial in the research area of innovation management (Guo *et al.*, 2019). The controversy covers many aspects of the theories developed initially by Christensen (Christensen, 2006a; Christensen, Raynor and McDonald, 2015) and certain critics suggested to improve the theory of disruption through the better understanding of overshooting (King and Baatartogtokh, 2015; Vázquez Sampere, Bienenstock and Zuckerman, 2016).

However, only a few scholars have discussed disruption as the consequence of overshooting (Christensen and Bower, 1995; Adner, 2002; Christensen, Verlinden and Westerman, 2002; Schmidt and Druehl, 2008a; Rhee, Schmidt and Van Orden, 2012; Klenner, Hüsig and Dowling, 2013; King and Baatartogtokh, 2015; Guo *et al.*, 2019). For those limited discussions, they tend to simply equate overshooting to the oversupply of unneeded product performance and rarely touch on the positive consequences of overshooting. The outcomes are the partial understanding of overshooting and anomalies unaccountable by existing 'oversupplied performance as overshooting - disruption' framework (Tellis, 2006; C. Christensen, Raynor and McDonald, 2015; King and Baatartogtokh, 2015). The following content will discuss disruptions consequent to oversupplied and compromised provision of product performance as well as their upside and downside consequences.

### 2.3.1. The Negative Consequences of Overshooting

Human beings normally have the intrinsic desire for product performance at a higher level, like better product quality (Swink, Talluri and Pandejpong, 2006; McNally, Akdeniz and Calantone, 2011), higher product novelty (Dewett and Williams, 2007; Earl and Potts, 2012), or more product features (Thompson, Hamilton and Rust, 2005). As an attempt to accommodate the expressed desires of customers, firms are rivalling each other into the acceleration of overshooting the product attributes explicitly desired by customers (Christensen, 1997). When customers are overprovided by the performance of certain product attributes, customers find products too expensive, overly featured to use, or unnecessarily good (Cohen & Levinthal, 1990; Christensen & Raynor, 2003; Lukas *et al*., 2013). The oversupply of product performance is engendered partially by the overprovision of unneeded performance and partially by the contradiction between the unlimited intrinsic desire of customers for an improved product performance and their limited absorptive capacity for needing, using, and affording the improvement (Christensen, 1997; Chen *et al*., 2013).

Such a situation is self-defeating to customer-oriented companies for which seems likely to overshoot customers. Nevertheless, being customer-oriented is not destined to overshooting and the curse is the expressed needs of customers. Slater and Narver (1998) draw the division between responsive customer orientation and proactive customer orientation. Responsive customer orientation implies the focus of attention and efforts on expressed customer needs while proactive customer orientation attaches importance to the latent needs of customers. Companies advocating responsive customer orientation tailor product attributes to the expressed needs of customers and persistently emphasise the product attributes explicitly favoured by customers (Lamore, Berkowitz and Farrington, 2013). The commitment to the expressed needs of customers leads to the overshooting or overprovision of the improvement on certain product attributes more than that needed by customers (Adner, 2002; Lukas *et al.*,

2013). Conversely, companies being proactively customer-oriented channel investment into the product attributes latently needed but far from being satiated, which makes them stand a lower chance of overshooting the improvement on those expressively needed product attributes (Narver, Slater and MacLachlan, 2004; Atuahene-gima, 2005).

Oversupplying the performance of product attributes explicitly needed by customers engenders diminishing customer satisfaction, so the willingness to pay by customers can be diminishing (Adner, 2002 p.671). Customers value the extra improvement less than before, so the price of the product category becomes stable over an extended period (Adner & Levinthal, 2001). Low-end disruptive innovation may take the chance to enter the product market with inferior product attributes at cheaper price (Christensen, 1997) or with inferior product attributes but superior alternative product attributes (Christensen and Raynor, 2003; Schmidt and Druehl, 2008a).

For example, Apple may risk nothing to overshoot its product design at the expense of time-to-market. The reason for that is because the design of a new product category is far from maturity and customers are willing to trade off or compromise time-to-market for a better design. Nevertheless, the Microsoft-Intel alliance was able to overtake Apple to dominate the mass PC market because the dominant design of the PC had emerged and PC design innovation after that was not as radical as it was prior to the emergence of this dominant design (Srinivasan, Lilien, & Rangaswamy, 2006; Tegarden et al., 1999) or was not as meaningful as before the emergence of dominant design (Serge A Rijsdijk, Langerak and Jan Hultink, 2011). The more incremental utility of design innovation after the emergence of the dominant design makes the trade-off between product design and time-to-market no longer as worthwhile as before for customers, which favours Microsoft-Intel alliance rather than Apple. While Apple still traded off or compromised time-to-market significantly for incremental or less meaningful improvements on PC design, Apple overshot its improvement on product design. Consequently, Microsoft-Intel PC can disrupt Apple PC with lower price or with superior product attributes

rather than product design. In that case, overprovided performance in design dimension as overshooting is consequent by disruptive innovation with sufficiently provided performance in design but other better alternative performance dimensions like cheaper price.

However, over-shooters, in this case, may still survive safely in the market segments highly demanding on the overshot performance dimension or characteristic of product (Christensen, 2006, p.50). The market segments are highly demanding on certain performance characteristics may because they actually need the better to bring them meaningful utility or the market segments have intrinsic human nature for the better even the better means no better actual utility (Cohen, 1988; Adner and Levinthal, 2001). Nevertheless, the over-shooter is not completely immune from disruption. The over-shooter's fate is contingent on how much the preferences of over-shooters' targeted market segments converge with that of the market segments served by disruptive innovators (Adner 2002). If without the convergence, customers targeted by over-shooters will not switch to other products and would still pay for the over-shooters' products, though with diminishing willingness to pay.

The convergence might never appear if disrupters cannot "maintain its performance advantage as it creeps upmarket in search of more and more customer" (Wessel & Christensen, 2012, p. 58). There is normally a trade-off for incumbent product between the overshooting product attributes by incumbents and the product attributes emphasized by disrupters. For example, the reason for mobile phones to disrupt landline phones is that mobile phone can maintain the performance of its unique product attributes, such as portability, while creeps up to improve the product attributes overshot by landline, like reliability and signal coverage (Rhee, Schmidt and Van Orden, 2012). The competence to break the trade-off between different product attributes is referred as 'extendable core' which means a product can be extended to be ambidextrous at the product performance characteristics used to be in trade-off with each other (Wessel & Christensen, 2012). Therefore, researchers endeavouring to balance the trade-off

between different product attributes need to take the trade-off-breakers into consideration (Hitt, Hoskisson and Ireland, 1990; Hauser, 2001; Swink, Talluri and Pandejpong, 2006). In fact, researches investigating about the product performance upon emphasizing certain product attributes, like time-to-market, often miss out those trade-off breakers who may cast a shadow on over-shooters (Kessler and Chakrabarti, 1996; Langerak and Jan Hultink, 2006; Chen, Reilly and Lynn, 2012; Stanko, Molina-Castillo and Munuera-Aleman, 2012).

If the trade-off cannot be broken, the trade-off between product attributes might well confine companies to serve their targeted market segments while overshooting other market segments by trading off/compromising other product performances needed by other market segments. For example, companies which keep improving the multi-functionality of a product might well do it in trade-off with the product's ease of use (Thompson, Hamilton and Rust, 2005; Burke, 2013). The negative consequence for the company is that it might lose the market segment valuing the ease of use. Actually, trade-offs of that kind exist between many product attributes like product quality versus cost (Swink, Talluri and Pandejpong, 2006), speed-to-market versus quality (Hauser, 2001) and product capability versus price (Lukas *et al.*, 2013). The wide existence of trade-offs exposes companies to the risk of overshooting by improving product attributes in trade-off with the attributes needed by certain customers.

In many circumstances, the trade-off can be broken, which enables disruptors to encroach more into the markets targeted by overshooting incumbents (Van Orden, van der Rhee and Schmidt, 2011; Rhee, Schmidt and Van Orden, 2012). In the case of Apple smartphone and Nokia feature phone, the Nokia phone had a more severe trade-off between the number of features and ease-of-use. Comparatively, iPhone had a more alleviated trade-off between the number of features and ease-of-use. In other words, iPhone further broke or alleviated the trade-off held by Nokia feature phone and disrupt into the mainstream market of Nokia phone. The case implies that the compromised performance as overshooting can be consequent by disruptive innovation

breaking the trade-off between compromised and overly improved performance characteristics or dimensions.

**Table 2: Decomposed Overshooting and Consequent Disruptions**

| Decomposed Overshooting | Mechanism | Consequent Disruption | Examples |
|---|---|---|---|
| **Compromised Performance** | *The oversupply of performance characteristics unneeded by customers makes the performance characteristics traded off or compromised of incumbent product needed by customers from the non-mainstream markets of incumbent unworthwhile* | *Opportunity for disruptors to reverse the trade-off by reducing the overprovided performance characteristics and improving the performance characteristics compromised or traded off by incumbent product (Trade-off-reversing Disruption)* | Four Seasons VS Motel 6 (Christensen *et al.*, 2018) |
| **Nonabsorbable Performance** | *The traded off or compromised provision of performance characteristics makes the focally improved performance characteristics of incumbent product needed by customers from the mainstream market of incumbent difficult to be absorbed or hard to be turned into meaningful utility* | *Opportunity for disruptors to break the trade-off by improving the compromised performance characteristics of incumbent product so that customers have better capacity to absorb the focally improved performance characteristics by incumbent product (Trade-off-breaking Disruption)* | Four Seasons VS Airbnb (Christensen *et al.*, 2018) |

By comparing disruptive innovations consequent to oversupplied and compromised nonabsorbable performance as overshooting (see Table 2), the trade-off between different performance characteristics makes a difference. In the former situation, the oversupply of performance unneeded by customers makes the performance characteristics traded off or compromised needed by certain customers unworthwhile, which consequently gives opportunity for disruptors to reverse the trade-off by reducing the previously oversupplied performance characteristics and improving the performance characteristics previously compromised, which is defined as ‘break-off-reversing disruption’ in this research. The case

about Apple PC and Intel-Microsoft PC in the 1990's is the illustration between compromised performance and trade-off-reversing overshooting.

In that circumstance, the previously defined oversupplied performance as overshooting is here renamed as compromised performance as overshooting. Although there are dual dimensions of the oversupplied performance as overshooting (see Table 1), the more salient dimension to overshoot customers is not through the oversupplied performance but through the compromised performance by focally improving certain product performances. For example, as the number of product features improves, the product usability may be compromised (Thompson, Hamilton and Rust, 2005). In that case, customers are not overshot by the myriad number of features even which may bring diminishing return to customers. The diminishing utility generated from extra product feature may not be so meaningful for customers but who should not reject it even which provides the least utility. The mechanism making customers to reject the extra product feature with the least utility is the compromised usability by the extra addition of product feature. Therefore, it is the compromised performance characteristics but not the oversupplied performance characteristics of a product cause customer to reject the product. The compromised performance dimension outweighs the oversupplied performance dimension to cause overshooting and hence the rename of the 'compromised performance as overshooting'.

In another situation, the traded off or compromised provision of performance needed by customers makes the improved performance characteristics of incumbent product needed by customers difficult to be absorbed or hard to be turned into meaningful utility, which consequently gives opportunity for disruptor to break the trade-off by improving the previously compromised performance characteristics so that customers have better capacity to absorb the previously improved performance characteristics, which is referred in this research as trade-off-breaking disruption. The case of iPhone and Nokia feature phone supports the situation for

the compromised or traded off ease-of-use of Nokia feature phone made Nokia customers hard to use or absorb the utilities brought about by the added number of features of Nokia feature phone or even cause 'feature fatigue' (Thompson, Hamilton and Rust, 2005). Conversely, iPhone broke the trade-off between feature numbers and feature fatigue by putting added features as Apps into App Store, which helps customers to better absorb the added number of features without causing feature fatigue.

The decomposed dimensions of overshooting and their correspondingly consequent disruptions can be well evidenced by the two cases discussed by Christensen et al (2018) in hotel industry. The high-end hotels, like Four Seasons, improved their offering to be overly luxurious and is thus not actually needed by low-end customers. Consequently, the discount chains, like Motel 6, reversed the trade-off between luxuriousness and price to offer hotel services with compromised luxury but at improved pricing for customers. In that case, it is the compromised performance characteristic of product – expensive price makes low-end customers to reject Four Seasons but not the luxury. On another side, Airbnb did not only reverse the trade-off at the initial stage of its development but also later leveraged its shared lodging and wide network to break the trade-off between the luxuriousness and availability or price, which enabled Airbnb to encroach into the high-end market targeted by high-end hotels, like Four Seasons. Those high-end customers who used to be refrained from absorbing or getting the luxurious hotel rooms due to low availability or expensive price can now easily get through Airbnb.

### 2.3.2. The Positive Consequences of Overshooting

Overshooting is traditionally regarded as negative in terms of its consequences for two major reasons. Firstly, as overshooting is a term with negative connotations, researchers are inclined to focus on the negative consequences of overshooting (Thompson, Hamilton and Rust, 2005; Christensen, 2006a; Lukas *et al.*, 2013). Secondly, overshooting does bring about negative consequences. As mentioned in previous sections, 'compromised performance' and

'nonabsorbable performance' are the decomposed dimensions of overshooting and may undermine market performances of product (Christensen, Anthony and Roth, 2004; Thompson, Hamilton and Rust, 2005; Serge A Rijsdijk, Langerak and Jan Hultink, 2011; Earl and Potts, 2012). However, there are several reasons why outcomes may be less negative as normally presumed. The following contents will provide more details regarding the positive consequences of overshooting (see Table 3).

**Table 3: Literature Overview: Positive Consequences of Overshooting**

| Author(s) | Positive consequences of overshooting |
|---|---|
| (Adner and Snow, 2010; Wessel and Christensen, 2012) | Overshooting may please customers with high threshold of the performance characteristics of product. |
| (Negro, Hannan and Fassiotto, 2015; Reinhardt and Gurtner, 2018) | Certain performance characteristics of products are socially embedded or related to authenticity, overshooting those performance characteristics of products are safe. |
| (Henderson *et al.*, 1990; Christensen and Bower, 1995; Narver, Slater and MacLachlan, 2004; Noda and Bower, 2007; Barnett and Pontikes, 2008; Adner and Kapoor, 2010; Changsu and Jong-Hun, 2010; Huang *et al.*, 2013) | Overshooting may simplify innovation space:<br>1) overshooting avoids the hassles of seeking and improving alternative performance characteristics of product;<br>2) overshooting does not entail radical changes to existing organisational competences including resource allocation pattern, technical competence or customer-facing competences;<br>3) overshooting does not need the rebuilding of value network supporting product values. |
| (Christensen and Bower, 1995; Porter, 1996; Siggelkow, 2002) | Overshooting may achieve strategic fit by constantly emphasizing certain product performances of strategic importance. |
| (Christensen, Verlinden and Westerman, 2002; Christiansen *et al.*, 2010; Serge A Rijsdijk, Langerak and Jan Hultink, 2011; Stanko, Molina-Castillo and Munuera-Aleman, 2012) | The misfit between external market environment and internal emphasis on certain product dimensions may cause overshooting. However, the market environment is not static and may shift to become fitting to the improvement on certain product dimensions again. If overshooting is temporary, the consequences of overshooting is not necessarily negative. |
| (Adner and Levinthal, 2001) | Overshooting or overproviding product performance may still be welcomed by customers with intrinsic desire for the better even the better only brings about marginal utility return. |
| (Adner, 2002; Wessel and Christensen, 2012; Christensen *et al.*, 2018) | As long as the trade-off between different performance characteristics of product is not broken, overshooting will be safe. |

One of the key factors profoundly affecting the product performance based on overshooting is the performance threshold of a product attribute. The performance threshold of a product indicates the level of performance below which customers will not be willing to pay for the product performance (Adner and Levinthal, 2001). The performance threshold of a product varies for different customers with different product usage, so a product which lives up to the performance threshold of one customer might well fall below that of another. As each attribute of a product is responsible for product performance to some extent, there is a performance threshold for each product attribute. For example, functionality is normally an important attribute of a product, so there is a functional threshold which means "*the minimum level of performance below which a consumer will not accept a product*" (Adner, 2002 p.671). By the same token, there are performance thresholds for quality, convenience, reliability and other attributes of products. Persistent improvement on a particular product attribute will please customers with high performance threshold of the product attribute since they are highly willing to pay for this product attribute and are thus less likely to be overshot (Adner and Snow, 2010).

As the rate of technology change normally accelerates over time (Smith, 2010 p.55), persistently improving the performance of a product attribute will finally reach the performance threshold of those who used not to pay for the product attribute. For example, the photographing capability of a camera phone can be improved to the degree of meeting the performance threshold of professional photographer. However, as long as the trade-off between the performances of different product attributes, more and less valued by different customers including ordinary phone user and professional photographer, are not broken, the preferences of different customers with high and low performance thresholds of the different will not converge on one product (Adner, 2002). In the market of camera phone, only when a camera phone is able to break the trade-off between the functionality as a camera, like resolution, and

the portability as a phone, the performance needed by a professional photographer will converge with that of a cell phone user on camera phone (Han, Chung and Sohn, 2009). Before that, overshooting the capabilities of professional camera may overshoot ordinary mobile phone users but will be welcomed by professional photographers.

The trade-off between the different performance characteristics of a product could be caused by the physical limit of technology. Technologies normally have 'physical limits' which is the ceiling on the improvement of technological performance (Foster 1986). The physical limits can be the scale or complexity of a product (Sahal 1981). When a product becomes unmanageably large or complex, a major advance of technology or radical innovation is needed to make further acceleration of technological improvement possible. Otherwise, customers will be overwhelmed by the complexity and scale of a more capable product trying to excel in the performance of multiple product attributes (Thompson, Hamilton and Rust, 2005). The physical limit of technology gives rise to the trade-off between different product attributes. Some companies, like Apple, are good at using trade-off-breaking innovation to conquer the companies whose products are positioned on certain trade-offs (Dyer, Gregersen & Christensen 2009). For example, Apple used to develop a personal digital assistant named Newton in an attempt to be ambidextrous at the portability and the functionality of a PC. The result was that Newton proved to be too complex to use and failed in the PDA market. Later, as technology progressed sufficiently to remove the physical limit bolstering the trade-off between the simplicity as tablet and the capability as PC, iPad was successfully launched to disrupt into PC market (Ragnetti, 2011). Therefore, overshooting the capabilities of PC only brings in stable revenue before the trade-off between PC capability and Tablet portability is broken.

As long as the physical limit is not removable, over-shooters may survive well in markets with high performance threshold of the overshot product attributes. However, anomalies still exist. For example, the laptop has obviously removed the physical limit of the desktop computer to

break the trade-off between the portability and functionality of a computer. Nevertheless, the desktop computer still safely overshoots its functionality and reliability in the market segment for office users even though the functionality and reliability threshold can equally be met by the laptop. Adner (2002 p.684) suggests an explanation that "*consumers with sufficiently satisfied functional requirements are more concerned with differences in absolute price than with differences in price/performance points".* According to this rationale, the reason that the desktop can survive in the market for office users is because the price of a desktop is cheaper than a laptop. Although the laptop is rated better for price/performance because of its combined benefits of portability and functionality, the lower price of desktop relative to laptop has separated the performance of functionality and reliability of the desktop from the portability of the laptop. In such a case, overshooting is still safe if pricing can separate the value of the overshot product attributes from trade-off-breaking innovation.

Apart from physical limit and pricing, there are also social and psychological factors which make overshooting safe in the markets with high performance threshold. The reason for it is because certain products' attributes can be socially and psychologically embedded, which make the real performance of the product attributes hard to be objectively assessed and hold trade-off-breaking innovation at bay (Cohen, 1988). Taking product quality as an example, as suggested by Negro, Hannan, and Fassiotto (2012 p.7), the quality of a product consists of two layers: the first is *abstracted quality* which is in nature about whether a product can live up to technical metrics and reliably function. Another is *contextualized quality* which is about whether a product is "*more socially embedded and involves typicality and authenticity*", like the region and tradition of production. Trade-off-breaking innovation might make a product better in terms of abstracted quality but not contextualized quality because the socially embedded perception of quality cannot be changed very rapidly. For example, biodynamic viticulture is priced more than organic viticulture to produce wines of similar quality, but

biodynamic viticulture is still believed by consumers as better for its quality based on some socially embedded bias. In that case, organic viticulture has removed the physical limit bolstering the trade-off between quality and price to some extent. However, biodynamic viticulture still survives in markets with a high performance threshold of wine quality. Therefore, trade-off-breaking innovations cannot be reliably assessed by customers "*even though in these cases the innovations have brought better products that could be sold for more attractive profit margins to the best customers of the incumbent leaders*" (Christensen 2006 p.50).

Another reason for companies to favour overshooting is the simplicity of persistently improving the same product attributes. Simplicity is defined as "*an overwhelming preoccupation with a single goal, strategic activity, department, or world view – one that increasingly precludes consideration of any others*" (Miller, 1993 p.117)**.** By practicing a simplistic innovation strategy, companies save the efforts of look for other goals, processes and resources which underpin an alternative innovation strategy.

Overshooting is such a strategy for product innovation that it may simplify the space of innovation in three aspects: first, companies acting on overshooting can leverage previously successful experiences of improving certain product attributes and avoid the risks associated with investing in the improvement on product attributes still implicitly needed by customers (Narver, Slater and MacLachlan, 2004; Barnett and Pontikes, 2008; Yu and Hang, 2010); second, an overshooting strategy does not entail radical changes to organisational competences including organisational architecture, culture, incentive system or resource-allocation pattern (Rebecca and Kim, 1990; Christensen and Bower, 1995; Kaplan and Henderson, 2005; Herrmann, Gassmann and Eisert, 2007; Noda and Bower, 2007); third, overshooting reduces the cost of rebuilding the value network needed to sustain product innovation (Christensen,

Verlinden and Westerman, 2002; Kim, 2006; Lee, Chen and Tong, 2008; Changsu and Jong-Hun, 2010; Parry and Kawakami, 2017).

Sometimes, although over-shooters may neglect alternative product attributes demanded by changing markets, it can still achieve initial success in a linear or stable market environment (Miller, 1993; Gilbert, 2005). Changing environments may put management under pressure to innovate out of box (Staw, Sandelands and Dutton, 2015) and motivate management to change routines of innovative practices (Driel and Dolfsma, 2009). The space of innovation tends to be broader in changing environments. Conversely, if market environments are stable, companies would not need to make radical changes to their marketing and distributing competences (Danneels, 2002; Suarez and Lanzolla, 2005). Furthermore, companies may develop the fit between competences in certain product attributes and the external environment over time (Manion and Cherion, 2009). The positive feedbacks between competence in improving certain product attributes and a specific market environment may become increasingly reinforced, which enables companies to stand out amongst competition. In the absence of radical environmental changes, companies can maintain their competitive advantages by constantly improving certain product attributes more efficiently than other competitors (Porter, 1996; Siggelkow, 2002).

Prior research have showed evidence for the market successes obtainable by adopting a simplistic overshooting strategy. Rijsdijk et al. (2011) and Adner & Levinthal (2001) find that product functionality is the attribute worth emphasizing at the initial stage of commercializing a product class for market has dynamic demand on new functions and features. Chen, Reilly, & Lynn (2012) contend that product development speed should be improved if customers' perception towards a product class is yet established. Christensen et al. (2002) state that the convenience dimension of a product should be prioritized for improvement when mass markets have already become satiated with the functionality and reliability of a product class. Although

the improvement on certain product attributes only fits the environment dynamics within certain market segments while overshooting others, companies can still achieve strategic fit based on the classic segment-target-position marketing paradigm in a heterogeneous market (Kotler, 1991; Corrocher & Zirulia, 2010).

Moreover, given the fit between overshooting certain product attributes and certain environment dynamics, overshooting may possibly be a temporary situation. The changeable environments might make certain product attributes obsolete and continued improvement on the obsolete attributes overshoots customers because the improvement may be overprovided or made at the compromise of the product attributes advocated by evolving environments. However, it is by no means definite that those overshot product attributes do not stand a chance of being in demand again. The rationale supporting the revival of those overshot product attributes is that the environment dynamics advocating the overshot product attributes may come back again. For example, the functionality and reliability of a product class may get overshot and the architecture of the product becomes commoditized (Christensen et al., 2002). As time goes by, the evolution of customer demand and technology may entail the change of product architecture, which will put the reliability and functionality of the product class in demand again (Christensen, Suárez, & Utterback, 1998). Therefore, an overshot product attribute may be disliked by customers now but demanded by them in the future.

The recurrence of market environments reviving the overshot product attributes is affected by both predictable and unpredictable factors. Predictably, there are regularities in the environmental evolution of technological markets and hence the different product attributes advocated by different stages of environmental evolution (Abernathy & Utterback, 1978; Adner & Levinthal, 2001; Christensen et al., 1997; Rijsdijk et al., 2011). Once the evolutionary cycle of a technological market starts over again, those once-overshot product attributes will predictably be in demand again. Unpredictably, new markets or new technologies may emerge

to trigger the revival of those overshot product attributes. For example, the handheld GPS was disrupted by the cell phone GPS in the mass market, but it may revive in the market for emergency usage of GPS (Wessel and Christensen, 2012). Therefore, companies considering product with overshooting problems as a failure forever may commit marketing myopia for the product only fails in certain product markets but could possibly be repositioned in a new product market (Adner and Snow, 2010).

All in all, overshooting still has many positive consequences: firstly, overshooting certain performance metrics of product could be welcomed by customers with high threshold of the performance metrics or intensive demand on those performance metrics ( McNally Akdeniz, & Calantone, 2011; Swink, Talluri, & Pandejpong, 2006; Wessel & Christensen, 2012); secondly, overshooting product performance may still be welcomed by customers with intrinsic desire for the better even the better only brings about marginal utility return (Adner and Levinthal, 2001); Thirdly, overshooting product may still survive disruptive innovations breaking the trade-off if the overshot dimension of product can be separately priced; Fourthly, overshooting is safe if the overshot performance characteristics of product are socially associated with product authenticity (Cohen, 1988); Fifthly, overshooting reduces innovation space by exploiting well-established market, organisational and value network resources (Christensen and Bower, 1995; Parry and Kawakami, 2017; Vecchiato, 2017); Sixthly, the shifting demands of customers may cause environment dynamics (Kesseler & Chaakrabarti, 1996; Rijsdijk *et al*., 2011; Chen *et al*., 2012), which can make once-overprovided product attributes in demand again (Christensen *et al*., 2002). Finally, although technology and markets are changeable in the long run, they tend to be stable in the short run. In the short run, emphasizing certain product attributes may achieve strategic fit between external environment and internal competences(Siggelkow, 2001; Olson, Slater and Hult, 2005; Christiansen *et al.*, 2010).

Given the many positive consequences of overshooting, the traditional view of regarding overshooting as negative for an organisation is inconclusive and the process through which the consequences of overshooting is turned from positive to negative need to be thoroughly investigated so as to maximize the benefits while minimize the harms of overshooting.

## 2.4. Coping with Negative Overshooting

**Table 4: Strategies Coping with Overshooting**

| | | |
|---|---|---|
| **Coping with Overshooting** | | 1. Reversing overshooting performance (Christensen, 1997) |
| | | 2. Extending overshooting performance (Adner and Snow, 2010) |
| | Market-oriented coping strategies | 3. Shelving overshooting performance (Christiansen *et al.*, 2010) |
| | | 4. Repositioning overshooting performance (Wessel and Christensen, 2012) |
| | | 5. Combining overshooting performance with new performance dimension (Raffaelli, 2018) |
| | Organisation-centred coping strategies | 1. Unlocking from the embedded competences serving certain needs of customers (Henderson, 2006; Vecchiato, 2017) |
| | | 2. Unbundling from the embedded cognitive frame of management (Tripsas and Gavetti, 2000; Thrane, Blaabjerg and Møller, 2010) |
| | | 3. Unlashing from the embedded routines of organisation (Henderson *et al.*, 1990; Christensen and Bower, 1995; Christensen and Raynor, 2003; Markides and Charitou, 2004; Gilbert, 2005; Andriopoulos and Lewis, 2009) |
| | | 4. Untying from the embedded technical competence (William J Abernathy and Clark, 1985; Goldenberg and Horowitz, 2003; Yu and Hang, 2011; Wan, Williamson and Yin, 2015; Nagy, Schuessler and Dubinsky, 2016) |
| | | 5. Untangling from the institutional constrains of organisation (Adner, 2002; Christensen and Raynor, 2003; Kaplan and Henderson, 2005; Lukas *et al.*, 2013) |
| | Value network based coping strategies | 1. Building up new downstream complementary assets (Roy and Cohen, 2017) |
| | | 2. Connecting with new downstream customers and complements (Adner and Kapoor, 2010) |
| | | 3. Escaping from governmental regulations (Huesig, Timar and Doblinger, 2014) |
| | | 4. Speeding up the availability of complementary products (Parry and Kawakami, 2017) |

There is more than one strategy to adopt as a response to overshooting (see Table 2). The most obvious strategy is to reverse the overshooting by reducing the overshot product to a more humble state or refrain from upgrading product too much (Moon, 2005). For example, an over-functioning camera can be downgraded to one with less functionality. The coping strategy has proved to be effective when Intel was confronting with low-end chips' disruption (Christensen, 1997).

Another coping strategy is quite the opposite of reversing overshooting product, incumbent companies could continue to extend the overshooting performance characteristics of product (Adner and Snow, 2010). While reversing overshooting performance of product is suitable for the circumstance of compromised performance as overshooting, extending overshooting performance of product is more proper for the situation of nonabsorbable performance as overshooting. When disruptive innovation comes along to break the trade-off the between the overshooting performance dimension and the compromised dimension of incumbent product, incumbent product could go further to extend the overshooting by continuing to improve the overshooting performance dimension so as to cause the difficulty for disruptor to break the trade-off. For example, a luxury hotel may elevate its guestroom and service to a higher luxurious level to feed off the disruption from Airbnb by making the luxury hardly measured up to by private household.

Nevertheless, since the negative consequences of overshooting are temporary, companies may choose to shelve their improvement on the overshot product attributes and wait for the revival of the demand on the overshot attributes at a later point of time (Christiansen *et al.*, 2010). Alternatively, companies may deliberately reposition the overshot product attributes into a favourable market environment (Adner and Snow, 2010). The handheld GPS was repositioned in the emergency usage market can be a good illustration (Wessel and Christensen, 2012).

Additionally, over-shooter can pivot on its overshooting performance dimension to another dimension of performance and use the pivoted performance dimensions as new product advantage. Since disruptors are likely to improve on performance dimensions alternative to the performance dimensions overshot by incumbents (Bohlmann *et al.*, 2013), incumbent can counteract by combining the overshooting performance dimension with other performance dimensions to create new market. For example, the Swiss mechanical watch survived the disruption from battery-powered quartz watch by pivoting its overshooting performance dimension in mechanical manufacturing to combine with new performance dimensions including craftsmanship, luxury and precision (Raffaelli, 2018). The pivoting strategy is also similar to one of the well-known 'blue ocean strategies' which differentiates offering by combing a 'non-consumption' dimension of product with existing consumption dimension of product (Agnihotri, 2016).

All the coping strategies aforementioned are market-oriented, overshooting can be in itself an problem of organisational competence embedment (Henderson, 2006; Vecchiato, 2017). Addressing the organisational problem of sticking to certain performance improvement trajectories could be the way out of overshooting. To be specific, overshooting certain performance characteristics of product could be the outcome of the embedded competences of serving certain customer needs (Henderson, 2006) or getting specific jobs of customers done (Vecchiato, 2017). In order to unbundle from the embedded competences, incumbent companies can access knowledges about new customer needs or jobs supported by disruptive technology through recruiting staff with that knowledges (Roy and Sarkar, 2016) or interact closely with new customers and downstream complementary product sellers (Adner and Kapoor, 2010). By the same token, other embedded competences engendering overshooting certain performance characteristics of product, including core rigidity, dominant logic, organisational architecture, incentive system, or organisational culture, are all the keys through

which overshooting problem could possibly be solved (Bettis and Prahalad, 1995; Adner, 2002; Thrane, Blaabjerg and Møller, 2010; Lukas *et al.*, 2013).

There is a stream of literature paying attention to the embedded technical competence of incumbent which might well cause overshooting as embedded competences (William J Abernathy and Clark, 1985; Goldenberg and Horowitz, 2003; Yu and Hang, 2011; Wan, Williamson and Yin, 2015; Nagy, Schuessler and Dubinsky, 2016). Technical competence is regarding the R&D and production competence of companies (William J Abernathy and Clark, 1985). When it is embedded within organisations, the embedded technical competence could make for difficulties in switching to competence-destroying technologies and confine incumbents to overshoot certain obsolete performance characteristics of product. Researches have touched on this area by suggesting several technical strategies to unlock incumbents from those embedded technical competences (Yu and Hang, 2011; Wan, Williamson and Yin, 2015; Nagy, Schuessler and Dubinsky, 2016).

Another way to unbundle from embedded competence is through setting up a new business unit independent of incumbent company (Christensen, 2006a). The new business unit is isolated from the impact of the embedded competences supporting overshooting. Conversely, a company may internally develop the capability of being ambidextrous at the overshooting performance dimension and alternative performance dimensions conflicting with overshooting ones (Markides and Charitou, 2004; O'Reilly and Tushman, 2008; Andriopoulos and Lewis, 2009).

Finally, overshooting certain performance characteristics could be the consequence of bundling with the value network of a product. Although the ecosystem or value network of incumbent may initially work as barriers to entry by disruptors (Ansari, Garud and Kumaraswamy, 2017), the same ecosystem or value network bolstering certain product performance characteristics

may also act as inertia to incumbents as they try to switch to improve alternative performance characteristics of product (Rosenbloom and Christensen, 1994; Klenner, Hüsig and Dowling, 2013). To unbundle from the network inertia, incumbents need to build up new value network including complementary products, upstream suppliers and downstream customers and complementary products (Rothaermel, 2001; Adner and Kapoor, 2010; Roy and Cohen, 2017; Reinhardt and Gurtner, 2018). Particularly, the downstream components of the value network are considered as important as incumbents disentangle from overshooting to improve new performance dimensions (Adner and Kapoor, 2010).

## 2.5. Antecedents of Overshooting

Sometimes, a phenomenon can be better understood through a theoretical lens revealing the underlying structure and mechanism of the phenomena (Thrane, Blaabjerg and Møller, 2010; Hang, Garnsey and Ruan, 2015a). The theoretical lens can be the prior theories regarding the underlying structure and mechanism of the phenomena. Before taking on the theoretical lens, the theoretical lens needs to be deducted from the results of the phenomena. Therefore, this section will go first to deduct from the antecedent of overshooting – 'persistent improvement' to the underlying structure and mechanism of the antecedent of overshooting – 'path dependence process'. The later part of this section will review prior literatures justifying the use of path dependence process as the theoretical lens to ascertain the antecedents of overshooting.

### 2.5.1. Persistent Improvement as Antecedents of Overshooting

One frequently seen input of overshooting is persistent improvement on a restricted scope of product performance characteristics like functionality, quality or price (Lukas *et al.*, 2013; Christensen *et al.*, 2018). Incumbent companies may constantly improve on the performance

characteristics of product for two purposes: one is to pursue higher margin of profits from the customers with more intensive demand on certain performance characteristics of product (Adner, 2002); another is to allocate companies' internal resources to better satisfy companies' targeted customers, so customers' demand on certain product performances will drive companies resource allocation pattern (Christensen and Bower, 1995). The persistent improvement may enhance certain performance characteristics of product to the level beyond the actual needs of customers or compromise other performance characteristics meaningful for the market segments served by companies, which leaves out opportunities for low-end or new market disruption (Van Orden, van der Rhee and Schmidt, 2011; Wessel and Christensen, 2012; Hang, Garnsey and Ruan, 2015b).

Scholars later realize that the jobs need to be done by customers, rather than customers themselves, may also restrict the scope of the improvement on the performance characteristics of product (Christensen, 2006b; Henderson, 2006; Vecchiato, 2017). It is pointed out that companies persistently polish up certain product metrics may because they routinize or rigidify their customer-facing competences in serving their targeted customers (Henderson, 2006). One technique to recognise the emerging needs of customers and unlock from the rigidified customer-facing competences is through observing the 'jobs-to-be-done' by emerging customers and build up competences according to their jobs (Christensen, 2006a). Particularly, the management of companies need to be aware of the jobs of customers done by disruptive innovations and rebuild up internal competences accordingly (Vecchiato, 2017). Therefore, the persistent improvement on certain performance characteristics of product can be 'job-driven'.

Apart from the market-driven persistent improvement, it is also possible that the persistent improvement on a restricted scope of performance metrics may because of the embedded competences of companies (Henderson, 2006). Some companies do so as they are incentivized to improve product performances bringing in higher profits margin (Adner, 2002) while others

are overly confident with their past success to focus on product attributes sustaining prior success (Barnett and Pontikes, 2008). In other occasions, it is the management of companies who lapse into a particular frame of thinking about which product attributes matter and thus keep improving certain product attributes (Methodist, 1986; Gilbert, 2005; Chesbrough, 2010; Thrane, Blaabjerg and Møller, 2010). However, some companies are aware of their persistent improvement syndrome but find it challenging to deviate from polishing certain product attributes due to sunk cost and resource-based rigidities (Henderson *et al.*, 1990; Leonard-barton, 1998; Tripsas and Gavetti, 2000; Sterman *et al.*, 2007; Gibbons and Henderson, 2012; Staw, Sandelands and Dutton, 2015).

Notably, although researchers point out that it is not difficult for incumbents to leverage upstream production resources and R&D competences to copy the technical performances of disruptive products (Christensen, 2006a; Adner and Kapoor, 2010), certain researchers still emphasize the technical and R&D difficulties of incumbents in switching to produce the performance characteristics of disruptive innovation (Yu and Hang, 2011; Hang, Garnsey and Ruan, 2015b; Wan, Williamson and Yin, 2015; Nagy, Schuessler and Dubinsky, 2016). Those technical competences can be categorized into five categorises which are Discontinuous Technical Standard (Nagy, Schuessler and Dubinsky, 2016), Subtraction, Multiplication, Division, and Task Unification (Goldenberg and Horowitz, 2003).

To be specific, Subtraction means to remove redundant or essential components so as to create additional values for product, like to remove the keyboard of PC to create Tablet. One of Yu and Hang's technological or R&D competence typology - Simplification is similar to Subtraction (Yu and Hang, 2011). Task Unification is to add a new task performance to an existing product, which is similar to the R&D competence considered as Augmentation (Yu and Hang, 2011). Multiplication means to make one or more copies of existing product components like double-bin trash (Goldenberg and Horowitz, 2003). Division means to

modularize product components, which is complemented by Wan, Williamson and Yin's research (Wan, Williamson and Yin, 2015) that modularization competence can be extended from product to process innovation. Finally, Discontinuous Technical Standard indicates the application of discontinuous technology, like new material, to substitute existing product or production (Nagy, Schuessler and Dubinsky, 2016). All those technical competences in R&D and production can be technically cannibalizing the product R&D and production of incumbents and hold them back to improve the product performances already overshot.

On the top of market and organisational factors, the external network of incumbent companies are also considered to confine incumbent companies to the improvement on a restricted scope of performance characteristics (Rosenbloom and Christensen, 1994; Klenner, Hüsig and Dowling, 2013). The reason is because disruptive innovation is not only based on the technical competence of a company but also on business model (Markides, 2006b). A company tends to reinforce the fit between different nods of the value network bolstering a business model to achieve its unique strategic position (Porter, 1996; Olson, Slater and Hult, 2005). The fit between different operational activities and stakeholders of value network is not confined to internal organisation, external fit with outside stakeholders is also essential for market performance (Siggelkow *et al.*, 2001; Siggelkow, 2002). In return, the external fit from external network may also exert inertia effects on companies and confine the companies' innovation efforts to a restricted cope of performance metrics of product. For example, the complementary distribution network, products or R&D alliance with competitors may all make companies inescapable from certain performance characteristics of product (Rothaermel, 2001; Kim, 2006; Changsu and Jong-Hun, 2010; Parry and Kawakami, 2017).

Now that the varied causes of persistent improvement are located, companies should be able to counteract disruptive innovation as long as they can unbundle themselves from sticking to certain performance improvement trajectories primarily needed by mainstream customers and

innovate to meet the secondary needs of customers (Bohlmann *et al.*, 2013). However, companies still need to pick out the right cause of their persistent improvement on certain product performance metrics when confronting with disruptions promoting alternative performance metrics. There is a need of the researches revealing the more underlying mechanism and their interrelationships of the different causes of the persistent improvement on certain product metrics so that companies may know which cause is more importantly antecedent of overshooting throughout its shaping process. Therefore, this research will investigate the underlying mechanisms driving market, organisational and value network factors amounting to overshooting so as to help companies to locate the antecedents of overshooting in timely manner.

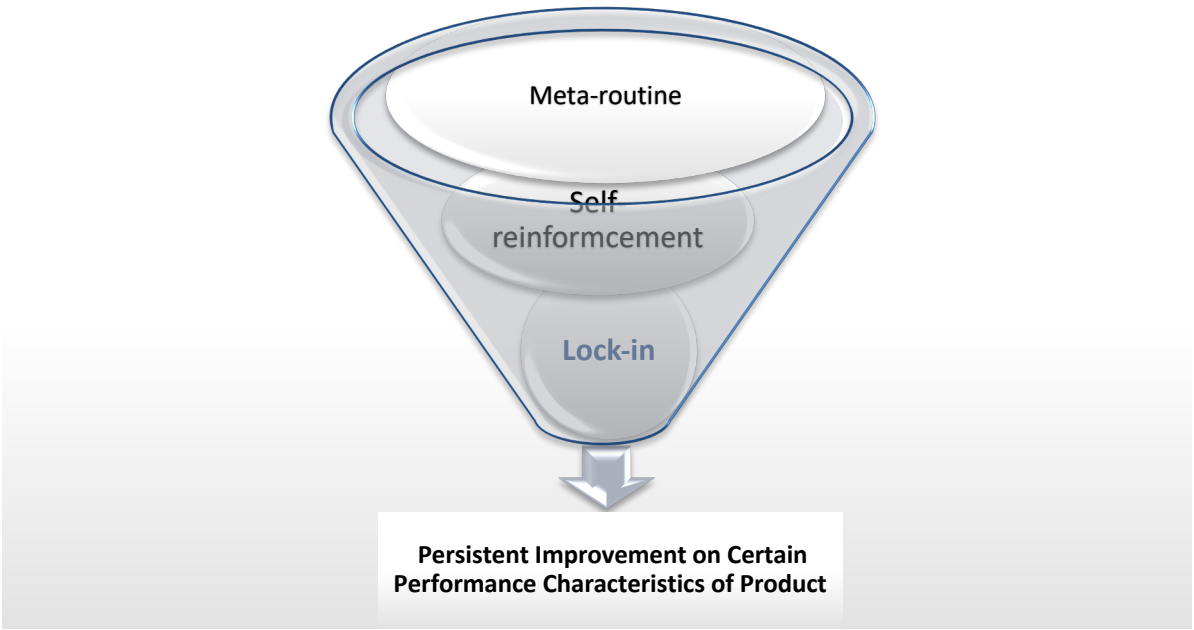
### 2.5.2. Persistent Improvement upon Path-dependent Behaviours

Vergne & Durand (2010 p.737) define path dependence as "a property of a stochastic process which obtains under two conditions (contingency and self-reinforcement) and causes lock-in in the absence of exogenous shock". According to Sydow *et al*. (2009), the path dependence process is constituted by three phases which are divided by two conjunctional points, 'critical juncture' and 'lock-in'. Critical juncture is the transitional point for the unrestricted scope of problem-solving practices to be transformed into self-reinforced patterns of practices (Collier & Collier, 1991). When self-reinforced patterns of practices become ever-increasingly entrapped inside the organisation in phase two, the patterns of practices will become unshakably fixed as they 'lock-in' at phase three. The three-phased process of path dependence mounts onto a state of routinized or persistent patterns of organisational behaviours.

Each of the three phases of path dependence process actually involves a mechanism contributing towards persistent pattern of practices or dependent path (Driel and Dolfsma, 2009; Dobusch and Schussler, 2012). As overshooting is frequently the outcome of the embedded pattern of organizational practices (Henderson, 2006; Vecchiato, 2017), the three mechanisms

of path-dependent practices are extendable as the theoretical lens to make sense of the persistent pattern of organisational behaviour or the antecedents of overshooting. As discussed in at the beginning of this chapter, 'compromised performance' and 'nonabsorbable performance' as overshooting can be consequent to the 'persistent improvement' on certain product performance characteristics, which also depicts the process of overshooting in the context of disruptive innovation (Christensen, 1997; Earl and Potts, 2012). To thoroughly understand why and how persistent improvement happens to result in overshooting, the underlying mechanisms or causes of the persistent improvement need to be explored. In that regard, the theory of path dependence process can be used to reveal the underlying mechanisms of persistent improvement for it comprehensively explains the persistent pattern of organisational behaviours (Sydow, Schreyögg and Koch, 2009; Vergne and Durand, 2010; Dobusch and Schussler, 2012).

**Figure 1: Three Underlying Mechanisms of Path Dependence Process**




As illustrated by Figure 1, the three mechanisms underpinning the process of path dependence are investigated as meta-routine, self-reinforcement, and lock-in (Driel and Dolfsma, 2009; Schreyogg and Sydow, 2011; Dobusch and Schussler, 2012). Meta-routine mechanism exists

at the first phrase of path dependence process and is defined as "a propensity to select particular solutions for certain types of problems" (Driel and Dolfsma, 2009 p.51). At the initial phrase, random and unpredictable events may act as initial conditions (Vergne and Durand, 2010). However, the enablers through which those random events are turned into self-reinforced pattern of activities are some other routines that select, mould or constantly cause the self-reinforced pattern of behaviours. The other routines are normally of a wider scope of organisational behaviours than the self-reinforced routines and so called as meta-routine (Driel and Dolfsma, 2009). The mechanism of self-reinforcement follows but differs from meta-routine mechanism that it is based on some positive feedbacks driving the persistence of organisational behaviours (Dobusch and Schussler, 2012). Later, the self-reinforcement mechanism will be transformed into lock-in mechanism, which means the previously escapable pattern of behaviours become embedded as the inescapable in spite of environment shifts (Schreyogg and Sydow, 2011).

The three underlying mechanisms of path dependence process can be used as the time-sequential framework to track the process of overshooting and ascertain the antecedents of overshooting more systematically and comprehensively (Sydow, Schreyögg and Koch, 2009). As discussed in previous section, there are a wide range of the antecedents of overshooting have been discovered in previous literatures (Christensen and Bower, 1995; Gilbert, 2005; Earl and Potts, 2012; Gibbons and Henderson, 2012; Lukas *et al.*, 2013; Vecchiato, 2017; Reinhardt and Gurtner, 2018). As overshooting is consequent to a persistent pattern of innovation efforts, the underlying mechanisms of path dependence or the persistent patterns of organisational behaviours can be leveraged to position the varied antecedents of overshooting according to the sequences of the three consecutive underlying mechanisms of organisational persistence.

Moreover, the theory of path dependence process subdivides the three underlying mechanisms of persistent patterns of practices into different types or forms (Schreyögg & Sydow, 2011,

p.325), which provides as more comprehensive and encompassing theoretical lens to ascertain the varied antecedents leading to overshooting. For example, the theory of path dependence process contends that organisations can be locked in a persistent pattern of behaviour, but in different forms: incumbents may have recognised the repercussions of organisational lock-in but are unable to unlock them due to resource-based embedment, like complementary asset, core rigidity, or sunk cost (Tripsas, 1997; Leonard-barton, 1998; Kim, 2006); organisations may be unaware of their lock-in with a particular path and have problems with their cognition of alternative paths for innovation due to embedded cognitive frame (Tripsas and Gavetti, 2000) or tacit knowledge (Gibbons and Henderson, 2012); organisations may have recognized their lock-in and are able to unlock, but do not feel motivated to do so due to institutional constraints like incentive system or organisational regulations (Fox-Wolfgramm, Boal and Hunt, 1998). Those nuanced subsets of the lock-in mechanism underlying persistent organizational practices could work as a more thorough and systematic examination over the antecedents of overshooting.

### 2.5.3. Three Underlying Mechanisms of Persistent Improvement

**Table 5: Persistent Improvement Based on the Mechanisms of Path Dependence Process**

| *Three Mechanisms of Path Dependence Process* | *Persistent Improvement Driven by the Three Mechanisms* |
|---|---|
| Meta-routine (Driel and Dolfsma, 2009) | Founder's background shapes certain characteristics of process or product innovation (Tripsas and Gavetti, 2000; Vergne and Durand, 2010). |
| Self-reinforcement (Dobusch and SchuBler, 2012) | Self-reinforcement between organisation structure and product structure (Rebecca and Henderson, 1990), mainstream market demand on and resource allocation to certain product attributes (Christensen and Bower, 1995), organisational culture and product superiority (Lukas, 2013). |
| Lock-in (Schreyogg and Sydow, 2011) | Complementary assets (Tripsas, 1997), value network (Christensen and Rosenbloom 1995), and cognitive frame (Trispas and Gavetti, 2000) may confine companies to stay with obsolete product characteristics. |

As displayed in Table 5, there are differences between the mechanisms causing the persistence of practice patterns at different phases of the path dependence process. At phase one, the persistence of practice patterns or the dependent path is yet to take shape. The process of taking shape is triggered by random and small events (Pierson 2004) which are termed as 'initial

conditions'. Those random and small events could be the personally experienced by management, founding imprinting or other accidental occurrences. Initial conditions transform the random pattern of practices into self-reinforced and more fixed patterns of practices. The transforming process is enabled through the mechanism of 'meta-routine' which refers to "*the propensity of selecting particular solutions for certain types of problems*" (Driel & Dolfsma, 2009, p.51). The propensity of selecting will give 'constant causes' to mould a specific pattern of practice. The recurrence of practice under the mechanism of meta-routine is not self-sustained or self-reinforced but realised through the 'constant causes' of initial conditions.

Although it is not dedicatedly documented, the mechanism of meta-routines gives rise to the behaviour of persistent improvement on certain product attributes. As initial conditions, the self-reinforcing mechanism in phase two "*can be triggered by rational, utility-driven behaviour, but can also result from emotional reactions, cognitive biases, or political processes*" (Dobusch & Schussler, 2012, p.621-622). For instance, Tripsas and Gavetti (2000 p.1149) observe that the founder's background in instant photography profoundly caused the Polaroid's difficulty in switching from the product attributes typical of instant photography to digitalized photography for many years after his departure. Toyota's just-in-time production system is heavily influenced by its founder's engineering education background which affected Toyota's production process persistently (Vergne and Durand, 2010). The constant causes brought about in the mechanism of meta-routines will dwindle as the positive returns from improving certain product attributes become increasingly significant to make the improvements self-reinforced. Therefore, the mechanism of meta-routines is extendable as the initial causal mechanism of the persistent improvement on certain product attributes.

Unlike the mechanism of meta-routine, the mechanism of self-reinforcement at the phase II of the path dependence process shapes the persistent pattern of organisational behaviours in a different way. The self-reinforcing mechanism indicates a process persistently reproduces itself

or a pattern of activities, automatically strengthening itself (Schreyogg and Sydow, 2011). The self-reinforced mechanism is normally fed by the positive return of following a specific pattern of practice (Sydow & Hock, 2009). When a persistent pattern of behaviours is enabled by the mechanism of self-reinforcement, the pattern recurs automatically without the constant causes from the mechanism of meta-routine. In classic literatures, path dependence is proposed as a notion to explain the evolutionary trajectory of technology ( Dosi, 1982; David, 1985; Arthur, 1989). One well-known example about self-reinforcement is the popularity of the QWERTY keyboard, which features a 'self-reinforcing' network effect (David, 1985).

Organisational self-reinforced practices are mainly sustained through four types of positive returns (Arthur, 1989; Sydow, Schreyögg and Koch, 2009): complementary effects, which is the synergy from two or more interdependent organisational resources or capabilities; learning effects, where an accumulated learning experience enhances the efficiency of operations which in turn adds to the attractiveness of a learning pattern; adaptive expectation effects, which are jointly held expectations that encourage more people to jump on the bandwagon to hold the same expectation; and coordination effects, which is the rule-guided behaviour that can reduce coordination cost and are more attractive for people to abide by. The four types of positive returns make a particular technology, business model or organisational structure self-reinforced inside an organisation (Rebecca and Kim, 1990; Bettis and Prahalad, 1995; Markides, 2006a). Notably, Arrow (2000) and Kay (2005) oppose that positive returns from a particular path is not compulsory for shaping a persistent pattern of behavior but a mechanism reducing the attractiveness of alternative paths, which can generate a positive return.

Like the mechanism of meta-routine, the mechanism of self-reinforcement is also extendable as the causal mechanism of persistent improvement on certain product attributes (see Table 5). For example, Christensen and Bower (1995) observe that companies tend to expel resource allocation which is incompatible with the product attributes demanded by their targeted

customers. As resources are persistently allocated as a response to the expressed demands of customers, the latent demands are likely to be ignored (Narver, Slater and MacLachlan, 2004; Lamore, Berkowitz and Farrington, 2013). The reason is because the positive feedback from the demand side adds to the robustness of the pattern of resource allocation (Pfeffer & Salancik, 1978). Therefore, product innovation is initiated to target latent needs but may not be commercialised later due to inadequate support of sources (O'Connor and Rice, 2013). Over time, feedback from certain customers advocate certain product attributes where improvement will result in satisfaction amongst certain customers. The self-reinforced loop between resource allocation patterns and customer demands confines innovation efforts to certain product attributes (Dobusch and Schussler, 2012).

The self-reinforced loop is not only existent between customer demands and product attributes, but also likely between product attributes and the HR incentive system, organisational structure, financial system, organisational culture, and other organisational elements (Henderson *et al.*, 1990; Kaplan and Henderson, 2005; Lukas *et al.*, 2013). Through the varied types of positive return fuelling the self-reinforced process (Arthur, 1989; Dobusch and Schussler, 2012), the antecedents reinforcing the improvement on certain product attributes can be further revealed and structurally categorized.

Self-reinforcement is precedent of lock-in mechanism in the process of path dependence. At phase two of path dependence process, self-reinforcing pattern of practices is efficient and rewarding. Afterwards, the self-reinforcing impetus becomes ever-increasingly inert to stop as the organisation ages and finally turns once-beneficial competences into core rigidity (Leonard-Barton, 1992). There are two prerequisites for turning the good into the bad: one is the accumulated inertia leading to the lock-in with a particular way of innovation; another is the changed market environment which makes the core competencies no longer appropriate or obsolete. For the accumulated inertia, its forming process can be explained by the four effects

of the self-reinforcing mechanism as previously mentioned (Arthur, 1994). At phase three, the persistence of a pattern of practices is no longer required to be self-reinforced as it is at phase two. Instead, the persistence of a pattern of practice will exist even if no significant positive return or feedback is derivable from sticking to a particular pattern of practice.

The self-reinforced pattern will finally become rigid to lock organisations in a limited scope or with fixed patterns of innovation. "*Lock-in characterizes a state of equilibrium with a very low potential for endogenous change – put simply, lock-in is a hard-to-escape situation*" (Vergne & Durand, 2010, p.743). The reason for the 'hard-to-escape situation' is because of core rigidity which is defined by Leonard-Barton (1992) as the "flip side of core capabilities" (p. 118) and "inappropriate set of knowledge" (p.118). Core rigidity is the obsolete capabilities of an organisation and can limit the scope of innovation. Organisational capabilities of various sorts are likely to become core rigidities. In prior research, core rigidity may include organisational architecture (Rebecca and Kim, 1990); technical systems, management systems, and value (Leonard-barton, 1998); complementary assets like distribution networks (Tripsas, 1997); business models (Markides, 2006a; Chesbrough, 2010); value networks (Christensen & Rosenbloom, 1995; Kim *et al*., 2006); and incentive systems (Bloom & Van Reenen, 2007). Behind those core rigidities are the ingrained mindsets, or cognitive framing, of the effectiveness of those core rigidities (Tripsas and Gavetti, 2000; Thrane, Blaabjerg and Møller, 2010).

"Lock-in may be dominantly cognitive, normative or resource-based in nature; actual organisational lock-ins are most likely to be the combinations of these three types of lock-in" (Schreyogg & Sydow, 2011, p. 325). Among the three types of lock-ins, resource-based lock-in is more visible than the other two as it is in the form of tangible resources, like human resources, manufacturing equipment, or the distribution network. For example, firms opening new product market might be held back to scale up the product into mass markets due to their

lock-in with market-opening resources (Markides & Geroski, 2005). To be specific, mass-producers tend to put weights on the barriers of entry like economies of scale, brand equity, supply and distribution networks, and industrial regulation (Suárez & Utterback, 1995; Christensen *et al*., 1998). In contrast, new market openers attach lots of importance to resources like ambitious entrepreneurs and engineering or technical dimensions of product improvement, which gets market-opening firms stuck with developing products for early adopters who demand product novelty and functionality (Moore, 1999; Christensen, 1997).

Normative lock-in can also cause persistent improvement on certain product attributes. "Normative paths are linked to the norm-based logic of appropriateness, which assumes that actions are primarily guided by rules, norms and identities rather than material interests or rational expectations" (Sarigil, 2013, p. 6). The mechanism of locking in a particular normative path is through the legitimatisation of behaviours. As commented by Mahoney (2000), "institutional reproduction occurs because actors view an institution as legitimate and thus voluntarily opt for its reproduction (p. 523)". The legitimatisation may be resulted from the incentive system, organisational value, culture, rules, and norms. Those normative set-ups make certain patterns of actions considered as appropriate to practice by organisational agents (Blyth, 2001; Cox, 2004); even certain patterns of actions are suboptimal in comparison with the alternatives. Existing research has recognised the relationship between normative lock-in and persistent improvement on product attributes. For instance, Burgelman (1999, p 250) found that Intel's focus towards memory chips as their core product strategy is partially attributable to its incentive system for promotion. Similar incentive constraints are also observed by Tripsas & Gavetti (2000) to relate to Polariod's inertia in switching to digitalized photography.

Finally, cognitive lock-in also builds up a persistent pattern of practices via the bounded rationality of people. When cognition gets locked into a particular frame of thinking, people are constrained in their ability to absorb and process information. To be specific, people

bounded by rationality are limited in the amount of information to absorb and process (Glbraith, 1971; Feldman & March, 1981) and the amount of information to retain and access (Feldman & March, 1981; Amit & Schoemaker, 1993). The same mechanism also applies to cognitively framed people who normally cannot recognize the existence of alternative cognitive options or cannot objectively assess alternative cognitive options. One good example to illustrate the lock-in process of cognition is 'success bias' (Barnett and Pontikes, 2008). Like a typical path-dependent process, a pattern of cognition would self-reinforce itself because of an increasing positive return (Arthur, 1989). The successful stories, as a positive return, boost the confidence of the decision-maker in certain patterns of practice and even triggers overconfidence in adopting the patterns of practice (Bazermand & Neale, 1986). The overconfidence screens out the information in conflicts with historical successes. Consequently, decision-makers will be unable to justly access alternative patterns of practice and make heuristic decisions based on previous successes as similar occurrences, available dates, or previously anchored values (Tversky & Kahneman, 1974; Gerrit Bruggen & Wierenga, 2010). The similar occurrences, available dates, and previously anchored values give information about a pattern of organisational behaviours resulting in organisational behaviours hard to deviate from, hence the persistent pattern of practices caused by cognitive lock-in.

Although heuristic decisions can be made by irrationally referring to similar occurrences, available dates, or previously anchored values, the likelihood to cause persistent improvement is not equally shared by the three types of heuristic decisions. The reason for it is because the three heuristic decisions stands a different chance to occur according to different decision-making processes (Tas and Teng, 1999). Fredrickson (1984) identifies the four steps of decision-making process involving situation diagnosis, alternative generation, alternative evaluation, and decision integration. However, the four steps place conflicting demands on decision-makers' ability to avoid heuristics. For instance, if a manager is rational and always

recognizes and assesses alternatives justly and objectively (Nutt 1984), the rational decision-maker may become overly confident with their decisions and easily have the illusion of being able to manage the consequences of their decisions. As a result, the manager may have done well in avoiding heuristic decisions induced by available dates or similar occurrences at the steps of alternative evaluation but their confidence in the outcome of alternative evaluation can be used irrationally as anchored value for decision integration or implementation. Therefore, heuristic decisions leading to a persistent pattern of practices are largely affected by how each step of decision-making is carried out.

In prior researches, evidence has been observed between cognitive lock-in and its impact on the persistent improvement on certain product attributes. For instance, cognition can be locked into a particular frame about technology (Dosi, 1982; Arthur, 1989), strategy (Prhalad & Bettis, 1986), or business model (Chesbrough & Rosenbloom, 2002; Markides, 2006). Indirectly, the cognitive lock-ins about technology, strategy, and business models will impose constraints on product innovation and therefore the persistent improvement on certain product attributes. Although people have reflexivity to see the economic consequence of their persistent pattern of practices by clinging to a particular path (Sabel & Zeitlin, 1997), they still find it hard to break away from the path. Empirically, cognitive lock-in has already been evidenced to cause persistent improvement on certain product attributes (Thrane *et al*., 2010; Tripsas & Gavetti, 2000). Therefore, the mechanism of cognitive lock-in is also extendable as the causal mechanism of the persistent improvement on certain product attributes.

### 2.5.4. Ascertain Overshooting via the Theoretical Lens of Path Dependence Process

Path dependence has been widely used to account for the phenomena in which historical antecedents matter and cast a long shadow over things ensuing the antecedents (Vergne and Durand, 2010). Since its origin in the field of technological diffusion (Garud, Kumaraswamy and Karnøe, 2010), path dependence has so far touched on the research areas including

institutional development in economics (Redding, 2002), organisational resource allocation (Christensen and Bower, 1995), knowledge management (Coombs and Hull, 1998), technological trajectory (Araujo and Harrison, 1997), and many others embodying the theme of path dependence.

In spite of the diverse applications of path dependence in different economics areas, those researches only share in common about one property of path dependence – 'history matters' (Vergne and Durand, 2010). However, history matters in many circumstances that are not necessarily related to path dependence, so path dependence needs to be more specifically defined as it is extended to interpret the phenomena of relevance. The more specified path dependence include two distinct mechanisms which are self-reinforcement and lock-in (Dobusch and Schussler, 2012). The two mechanisms will diminish a wide scope of organisational behaviours into a more restricted scope or fixed pattern of behaviours. Nevertheless, this research include a third mechanism – meta-routine to capture the very initial phrase of organisational persistence (Driel and Dolfsma, 2009). The three mechanisms mounting to a persistent pattern of practices will act as distinct theoretical lens to interpret the phenomenon of overshooting.

On another side, the persistently patterned improvement on product performance can be initiated, solidified and embedded at different points in time and hence the variation of the antecedents of overshooting over time. Previous research tend to emphasize one or two antecedents at one point in time (Hauser, 2001; Thompson, Hamilton and Rust, 2005). Nevertheless, overshooting is normally taking shape through accumulative and incremental causes over time and is better to be clarified in its time-sequential context. Also, some of the antecedents of overshooting may initially be beneficial but were later transformed to cause overshooting due to environmental dynamics (Serge A Rijsdijk, Langerak and Jan Hultink, 2011). Correspondingly, "*the path dependence construct pays attention to which dynamics lead*

*to which kinds of outcomes, whereas other constructs focus more on early events (e.g. imprinting) or final outcomes (e.g. structural inertia)*" (Dobusch and Schussler, 2012 p.619). Therefore, the theory of path dependence process is particularly suitable to be taken as theoretical lens for it helps to reduce to risk of taking a temporary or static view about the antecedents of overshooting.

Also, the consequences of overshooting are likely to vary according to the antecedents of overshooting driven by different underlying mechanism. This research particularly investigates disruptive innovation as the consequence of overshooting, so the variation of disruptive innovation could possibly be related to different underlying mechanisms of path dependence process. prior researches consider the variation of disruptive innovation in terms of disruptors' encroachment pattern. Christensen put disruptive innovation into two categories which are low-end and new market disruptions (Christensen, 2006a). later researchers complement that disruptive innovation may also encroach from the high-end and fringe markets of incumbent products (Schmidt and Druehl, 2008b; Rhee, Schmidt and Van Orden, 2012). Despite the different encroachment patterns of different disruptive innovation, all those disruptive encroachments follow two steps to achieve full disruption: the first is to set foothold in the market niches outside of the mainstream market of incumbent companies; the second is to encroach into the mainstream market of incumbent companies. The two-step process is essentially the evolutionary process of disruptive innovation. Coincidently, the three mechanisms underlying the antecedents of overshooting are also in the form of evolutionary process. The possible correlation between the two evolutionary process concerned with overshooting is likely to be another important theoretical development opportunity regarding the disruption as the consequence of overshooting.

## 2.6. Overshooting & LMS Industry

### 2.6.1. LMS in the Higher Education Sector

This research will investigate overshooting through the market evolution of LMS in the higher education sector which was mainly pushed by four waves of technological advances. The first wave was internet technology which called for putting everything online. In the late 1990's, there was a trend for initial LMS to put the daily management of teaching and learning online, which drove the founders of different early LMS companies to develop courseware with features enabling teaching and learning activities online (Burn, 2006; Reinhart, 2012a; Justin, 2015c). The early representatives of those 'online makers' were Blackboard, WebCT and Desire2Learn which were founded in the late 1990's or early 2000's (Lederman, 2017).

Those online makers all initially expanded their business successfully through adding up to the LMS features getting learning or teaching activities online. Particularly, Blackboard and WebCT became the market leaders for the LMS market in the American higher education sector (Web, 1998; Angelo, 2002). However, Blackboard stood out from the crowd by actively merging with other LMSs (Harper, 2006). In 2005, Blackboard merged with WebCT to account for 75% market share in the American higher education sector (Empson, 2012a).

The merger and acquisition strategy worked well initially for Blackboard for it helped its LMS to substantially improve in terms of the number of LMS features. As the initial market for LMS was far from saturation at that time, adding to the number of LMS features faster than competitors to was a key competitive advantage (Henderson, 2012). As external acquisition is faster than internal development to contribute to LMS features, Blackboard's merger and acquisition strategy helped it to become sole dominant market player in 2005.

However, the years afterwards became the history for different rival LMS to encroach into the market dominated by Blackboard. The market share of Blackboard LMS fell from 71% in 2005

to 44.8% in 2012 in the American higher education sector (Campus Computing Project, 2011). Meanwhile, three of its major rival LMS gained mostly from the loss of Blackboard: the market share of Desire2Learn LMS rose from 2% to 11.6%, Moodle LMS' market share rose from 4.2% to 20.1% and Canvas LMS started from scratch to 4.6% since 2006 to 2012 in the American higher education sector (Green, 2012). Up to the year of 2016, Desire2Learn, Moodle and Canvas were the top three LMS eroded the market shares of Blackboard (Phil Hill, 2016b).

The continuous losing ground to rival LMS since 2006 came along with another three waves of technological changes in the LMS industry. The first one was the surge of LMS companies based on open source business model (Dobre, 2015). Open source allowed LMS companies to leverage free software developers around the world to add to LMS features, which rendered Blackboard LMS more expensive than open source LMS. Also, open source allowed LMS adopters to build up their own LMS, which attracted many of Blackboard's customers as Blackboard continued to sell more its newly added LMS features to customers by force (Justin, 2015c). As open source LMS continued to encroach into the market served by Blackboard, Blackboard was forced to react by acquiring two leading Moodle Partners in 2012 (Kolowich, 2012a).

Another wave of technological advance inflicted heavy loss on Blackboard was cloud technology and Software as Service (SaaS) model. LMS companies based on cloud technology and SaaS contrasted Blackboard by going around university IT administrator to interact directly with teachers and students as end users (Feldstein, 2010a). The outcome was more end-user-friendly LMS which took lots of the market shares from Blackboard. The most outstanding company based on cloud technology and SaaS was Canvas which almost replaced Blackboard to become the market leader in the American LMS market in the year of 2018 (McKenzie, 2018).

The third wave of technology advance in the LMS industry was artificial intelligence which enabled an important feature of LMS – adaptive learning. Desire2learn took the lead in incorporating artificial intelligence into its legacy LMS so that its LMS may adapt learning content according to the personalized needs of learners (Reinhart, 2012c; Empson, 2013a). The new feature helped Desire2learn to take some long-term Blackboard clients away (Jamieson, 2017c, 2017d). However, artificial intelligence only partially explained the encroachment into the market of Blackboard, some other factors including its concentrated investment into its LMS product line also partially contributed to its success whereas Blackboard spread its investment into different product lines (Wan, 2013; Overly, 2014).

Blackboard later realized the problems with its product strategy and managed to stop its loss to rivals. The general strategy to for Blackboard to counteract rival LMS was to emulate the advantages of rival LMS. Blackboard developed its own version of LMS based on cloud technology and SaaS (Straumsheim, 2017). Also, Blackboard acquired Moodle Partners as its open source product line (Kolowich, 2012a). Moreover, Blackboard combined its different product lines into its LMS (Overly, 2014; Hensley-Clancy, 2015). The recovery strategy helped Blackboard to stop its decline in market shares and largely alleviated its loss to rival LMS (Straumsheim, 2017). Up to the midpoint of 2019, 95% of the LMS market share in the higher education sector of North America was shared by the 'Big Four' which were Blackboard, Canvas, Moodle and Desire2Learn LMS (Hill, 2019). The same pattern of market evolution in America also happened but at a delayed pace in Canada and Europe (ListedTech, 2018).

### 2.6.2. LMS Industry from Overshooting Perspective

The evolution of LMS industry in the higher education sector has profound implications for the research questions and objectives aforementioned. On the first place, the encroachment of different rival LMS into the mainstream market is not explainable by existing theories of overshooting and disruption (Adner, 2002). The mainstream market of Blackboard LMS were

consistent of customers with intensive demand on the number of LMS features, which means those customers were not supposed to be easily content with or oversupplied by the myriad number of LMS features. However, as described in the last section, the mainstream market of Blackboard was all evidently eroded by rival LMS including Canvas, Desire2learn and Moodle while Blackboard had been improving the number of LMS features as demanded by mainstream customers.

Existent theories also suggest that customers with intensive demand on certain product performances switched to rival products because incumbent product is overconcentrated in improving certain product performances (Christensen, 1997; Adner, 2002). However, it is odd that customers with intensive demand on certain performance dimensions suddenly have interests in alternative dimensions (Adner, 2002). The encroachment process of rival LMS into the mainstream market of Blackboard will show if the mainstream customers switched to rival products really because of the incumbent's overconcentration on certain performance dimensions and rival products' offering of additional performance dimensions.

Another interesting aspect of LMS industry is that it also illustrates the process through which the market peripheral to the mainstream market of incumbent is overshot. Existing theories explains the process by saying that the peripheral market is overshot because incumbent product supplies product performances more than that needed by peripheral market (Christensen *et al.*, 2018). However, the researchable question is about why customers get too much of a good thing? Prior researches suggests that it may not be the oversupplied performance but the compromised performance in trade-off with the oversupplied performance actually gets customers too much of a good thing (Thompson, Hamilton and Rust, 2005; Chen, Reilly and Lynn, 2012).

In the LMS market, Moodle and Desire2Learn LMS were evidenced by prior researches that they are less than Blackboard LMS for the number of features but are better in terms of price, customizability and usability (Lalande and Grewal, 2012; Dobre, 2015; Poulova, Simonova and Manenova, 2015). Moreover, Blackboard LMS is assessed in a research to be not so customizable, user-friendly and feature-ridden (Zanjani *et al.*, 2017). Therefore, the encroachment of rival LMS into the peripheral markets of Blackboard LMS will provide as good illustration to see if it is the oversupplied features or the compromised customizability and usability of Blackboard LMS dissatisfied customers.

Moreover, the antecedents and consequences of overshooting will be found out through the two-decade longitudinal history of Blackboard, Inc. The longitudinal history of Blackboard covers its inception, its peak, decline and recovery in terms of market performance. The wide spectrum of coverage will reveal about the shaping process of Blackboard's overshooting on LMS features and consequent disruptions from rival LMS throughout the whole process of overshooting. Given the different antecedents of overshooting documented before (Christensen and Bower, 1995; Tripsas and Gavetti, 2000; Lukas *et al.*, 2013; Vecchiato, 2017), this longitudinal case will show which antecedent was more salient at different point in time. Also, the disruption from rival LMS over Blackboard will demonstrate the mechanisms through which disruptive LMS companies made innovation against the different of antecedents of incumbent Blackboard's overshooting over time.

Finally, the case data from LMS industry will show how can overshooting be coped by incumbent. Blackboard later realized and counteracted rival threats by emulating Moodle, Canvas and Desire2Lean. In 2012, Blackboard acquired two of Moodle Partners (Kolowich, 2012b). Since then, Blackboard refocused its services on end-users and released Blackboard Ultra to as the Cloud-based and SaaS LMS solution (Feldstein, 2013; Lapowsky, 2015b; Schaffhauser, 2016). Meanwhile, Blackboard doubled investment into its core LMS and

acquired external innovations to strengthen its LMS (Empson, 2013b; Young, 2013; Wan, 2014b). All those will provide as natural experiments to see their implications for the feasible coping strategies to incumbent's overshooting.

## 2.7. Conclusion

This chapter summarizes preconceptions and theoretical lens to be later triangulated with case data for further theory development (see Figure 2). On the first place, the definition of overshooting are previously as the overprovision of product performance (Lukas *et al.*, 2013; Christensen *et al.*, 2018). This research finds literatures supporting that the compromised performance induced by improving other performance metrics of product might well be right mechanism of overshooting (Thompson, Hamilton and Rust, 2005; Han, Chung and Sohn, 2009; Chen, Reilly and Lynn, 2012). Also, this chapter discusses another dimension of overshooting which is nonabsorbable performance as overshooting. The two decomposed dimensions of overshooting may possibly explain overshooting the in the mainstream market and the peripheral market of incumbent product.

This chapter further summarizes the prior theories regarding the positive and negative consequences of overshooting. Positively, overshooting may satisfy customers with more intensive demand on the overprovided performance characteristic of product (Adner, 2002; Adner and Snow, 2010), enhance strategic fit to consolidate strategic position (Porter, 1996; Siggelkow, 2002; Olson, Slater and Hult, 2005) and simplify innovation space in linear environment (Sanchez, 1995; Narver, Slater and MacLachlan, 2004; Gilbert, 2005; Ruan, Hang and Wang, 2014). Overshooting product performance may be welcomed by customers with intrinsic desire for the better even the better only brings about marginal utility return (Adner

and Levinthal, 2001). Overshooting is safe if the overshot performance characteristics of product are socially associated with product authenticity (Cohen, 1988).

Negatively, overshooting may lead to disruptions (Christensen, Raynor and McDonald, 2015). Overshooting can be decomposed into two circumstances which are overprovided and compromised performances. The overprovided performance may give opportunities to disruptors to reverse the overprovided performance dimension and improve alternative performance dimensions. The compromised performance could make room for disruptive innovations breaking the trade-off between the compromised and the persistently improvement performance dimensions by incumbent so that the targeted customers of incumbent may better absorb the persistently improved performance dimension needed by them.

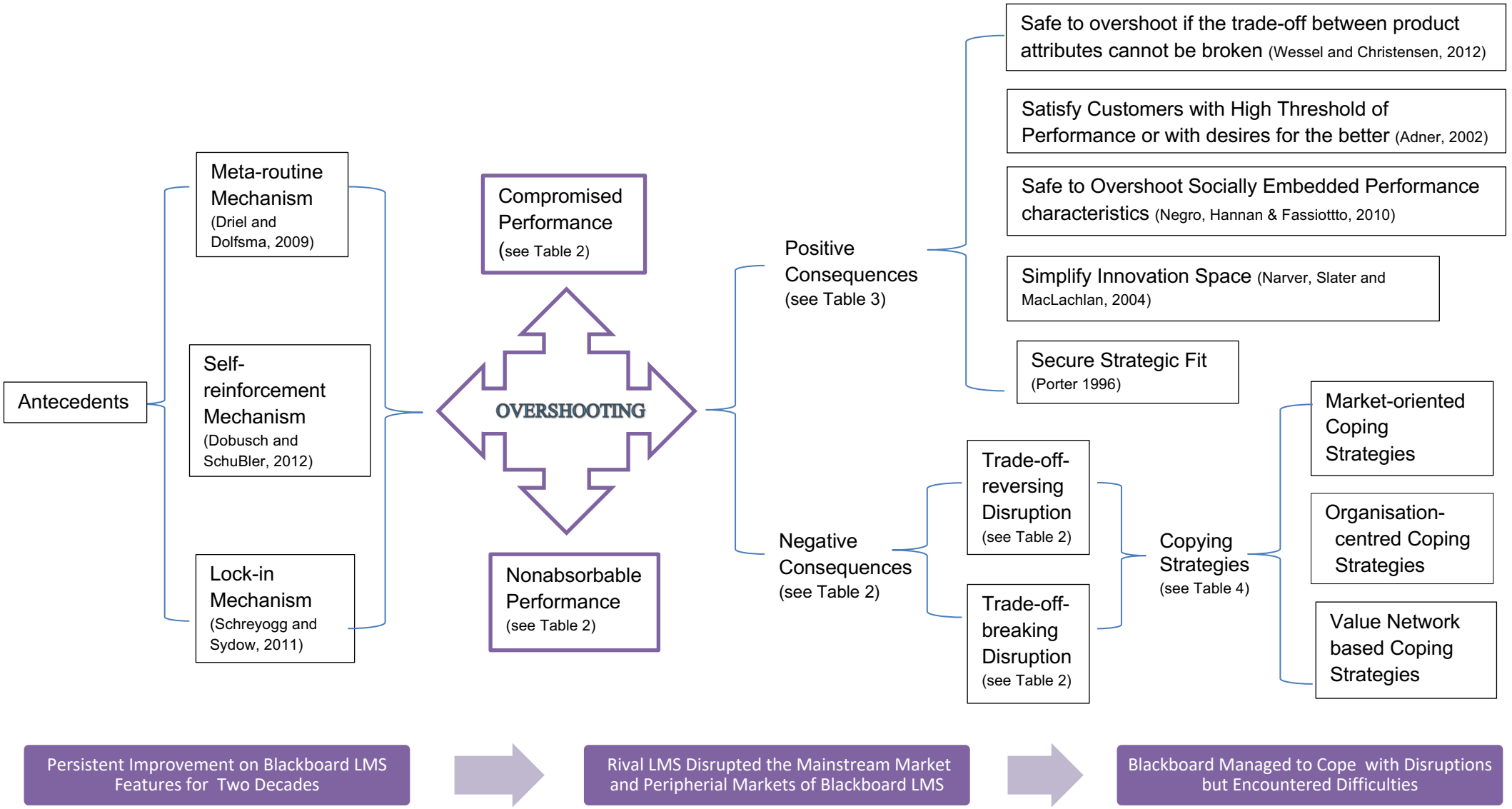
Various antecedents of overshooting are found in literatures (Miller, 1993; Christensen and Bower, 1995; Tripsas and Gavetti, 2000; Thompson, Hamilton and Rust, 2005; Lukas *et al.*, 2013). However, those contingency-based antecedents of overshooting may be driven by a more underlying structure and mechanism which could possibly be identified through the theoretical lens of path dependence process (Schreyogg and Sydow, 2011). More importantly, the three mechanisms of path dependence also provide a structured framework to position the different antecedents of overshooting based on their relationships with overshooting. However, this does not mean that the theory of path dependence outshines other theories concerned with persistent pattern of organisational behaviours, such as structure inertial or organisational imprinting (Hannan and Freeman, 1984; Vergne and Durand, 2010); they may all be used to the same end. However, path dependence is picked out because it is concerned about the interrelationships between different underlying mechanisms of the persistent pattern of behaviours (Dobusch and Schussler, 2012 p.619). Moreover, more than 35 years of academic efforts should have made this theory comprehensive enough to thoroughly and structurally

ascertain the antecedents of any persistent pattern of behaviour and its resultant impacts, like overshooting (Thrane *et al*., 2005 p.933).

Apart from the path dependence process as theoretical lens, this research will also resort to the prior theories and the deductive themes from the literature review of this chapter to serve as preconceptions for theory development (Eisenhardt, 1989; Sekaran and Bougie, 2010). Figure 2 shows the major theoretical lens, prior theories and deductive themes to be used as preconceptions to be compared later with the case data so that theories can be developed and extended from existent knowledge. Among those preconceptions, compromised performance and nonabsorbable performance as overshooting, the trade-off-reversing disruption and trade-off-breaking disruption are the themes or constructs deducted from literature reviews.

This research also investigates through the case data from the LMS industry in the higher education sector to extend and illustrate the preconceptions in Figure 2. The corresponding relationships between case data and the preconceptions are mainly divided into three sections: firstly, the persistent improvement on Blackboard LMS features over two decades' time is corresponding to the underlying mechanisms driving the path dependence on certain fixed pattern of organizational behaviors; secondly, the disruption into the mainstream market and peripheral markets of Blackboard could be a reflection on the decomposed dimensions of overshooting; finally, Blackboard's coping with disruption with difficulties can be informative about the tactics dealing with overshooting. The part of the case data regarding Blackboard LMS and its rival LMS is displayed under its corresponding preconceptions in Figure 2.

## Figure 2: Theoretical Lens, Prior Theories and Deductive Themes as Preconceptions



# 3. CHAPTER THREE: METHODOLOGY

## 3.1. Introduction

This chapter will detail about the research methodology adopted to solve the research questions specified in the first chapter. The first section is regarding the philosophical assumptions taken for this research. In line with the research philosophy, the specific research design and method are expounded in the next section. Followed the research method are the sections about informant's selection and data generation. As this research is mainly using case study method, so case analysis methods are detailly expounded in this chapter. The last section will discuss the ethical issues of this research.

## 3.2. Research Philosophy

Research is supposed to be conducted based on certain philosophical assumptions which tell about what reality and knowledge are. Over time, those philosophical assumptions have evolved into several paradigms. Sobh and Perry (2006) summarizes four major research paradigms which are positivism, critical realism, critical theory and constructivism. Each paradigm comprised by three elements: ontology, epistemology and methodology (Healy and Perry, 2000). Ontology is about how researchers view the world (Farquhar 2012). For instance, the world can be viewed as either totally independent of subjectivity or completely constructed by the subjective human. As a consequence, researchers with different ontology would take different views about what knowledge is true and how researchers should approach research subjects, which

results in different epistemologies (Gray, 2009). Furthermore, those epistemological views will affect research methods including data collection, analysis, and theory development. Therefore, ontology, epistemology and methodology should be consistent with each other under a particular paradigm.

Different paradigms of research philosophy emphasize and fits different research methodologies. Positivism emphasizes the objectivity of measuring and observing. In order to achieve the objectivity, positivists normally manage to be value-free and minimize bias in the process of research (Sobh and Perry, 2006a). Hypothesis-testing often follows up the objective operationalization of concepts in a deductive manner. Critical realism suggests that reality can be existent in separation from subjective mind but cannot be absolutely ascertained. The fallible interpretation of reality is due to the limitations of human constructions (Easterby-Smith and Thorpe, 2001). As truth is difficult to be obtained without bias, realists are more willing than positivists to tap into the perceptions of people to see how reality is constructed. Critical theory posits that reality is historically shaped and coloured by social, political, economic and ethnic values (Farquhar, 2012). The paradigm entails dialogue between researcher and subject. Each subject may report a different value and this incommensurability of perception are allowed (Sobh and Perry, 2006). Finally, constructivists think reality is inseparable from human constructions. People assign different meanings to the realities and researchers' active participation in research are necessary for understanding how reality is constructed by people (Gray, 2009).

The paradigm adopted by this research is critical realism. Although the phenomenon of overshooting in product innovation is not separable from the perceptions of customers and researchers, overshooting is still an existence based on collective perception of customers and researchers but not individual customer and researcher (Sobh and Perry 2006). Constructivism and critical theory are not appropriate here for they attach more importance to the individual perception of reality than the collective perception of reality. Moreover, as overshooting is a problem already been studied in the context of disruptive innovation (Thompson, Hamilton and Rust, 2005; Christensen, 2006b; Lukas *et al.*, 2013; Christensen *et al.*, 2018), this research will not verify or falsify those prior or new discoveries but to build upon those prior theories as the tips of a deeper underlying theoretical iceberg. Therefore, critical realism is the more proper than positivism paradigm for this research.

Positivism advocates the methodology verifying theory but not discovering theories in newly developed research field (Deshpande, 1983). Positivists tend to develop theoretical hypotheses in deductive manner, which means those falsified hypotheses need to be deducted again. However, the deduction process is usually derived from others' work which might well be irrelevant or unimportant to the research object itself (Christensen, 2006 p.44). The situation often occurs in research fields that is yet to be mature (Deshpande, 1983). One explanation for that may because the research object is yet to be inducted enough so that important factors, categories of phenomenon or intervening circumstances or contexts are yet be observed and taken into consideration.

If so, further verification of the theoretical hypotheses based on large scale of samples may produce conflicting results (Sobh and Perry, 2006a).

In fact, the traditional view of overshooting has been tested based on large scale of samples to poorly predict disruption (Sood and Tellis, 2010; Klenner, Hüsig and Dowling, 2013; Guo *et al.*, 2019), which is in conflict with existing theories (Yu and Hang, 2011; Christensen, Raynor and McDonald, 2015; Christensen *et al.*, 2018). Given the conflicts, it could be the right timing to go back to the construct of overshooting itself to see if there are new factors, categories of phenomenon, or intervening circumstances to refine the traditional view of overshooting. Otherwise, positivists will simply reject whole idea of overshooting and its consequent disruption through the testing based on a large sample of population (Sood and Tellis, 2010). Therefore, the paradigms advocating more about theory discovery could be in order.

The paradigms supporting the methodologies in inducting new constructs, categories of phenomenon or intervening circumstances tend to be critical realism, constructivism and critical theory. However, their differences in ontology make critical realism particularly appropriate for this research. Constructivism and critical theory often come into blame for their ontologies allowing for different realities to be constructed, which causes difficulties to tell which one is the true reality or to generalize one particular reality (Howell, 2013). By contrast, critical realism still admits one reality though which remains imperfectly understandable through the subjective efforts of human. The multi-reality orientation could be more suitable for certain researches that the research objects are jointly determined by the different inner minds of a few people or different

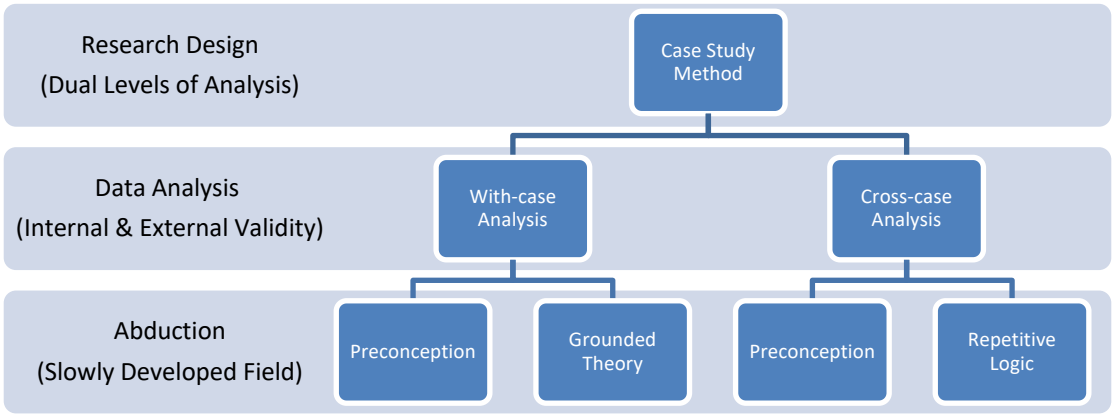
constructed realities, like knowledge sharing (Howell and Annansingh, 2013). However, when one of the multiple realities is locally constructed in accordance with the research object itself, it is pragmatic to take the reality as the yardstick of true reality. For example, in spite of the different realities constructed by companies and markets, the realities socially constructed by markets can be regarded as the true realities of marketing researches for market is the key research object (Sobh and Perry, 2006a).

The same rationale holds up for positivism as well. When physics researches are in question, the research objects tend to be those existences, including substance, energy, space or time, independent of human minds and hence the value-free reality is ensured to reflect the research objects in physics studies.

By the same token, the overshot customers as this research object construct the true reality of overshooting, the sensed or constructed overshooting by customers are more important than incumbent companies who produces overshooting product and whose reality will be ultimately judged by the reality constructed by customers to see if overshooting truly happens. Therefore, critical realism is more suitable than constructivism and critical theories as the basic methodological assumptions when different constructed realities need to be unified in one reality as research object.

## 3.3. Research Methods & Justification

**Figure 3: Research Methods**




The key research methods are summarized in Figure 3. On the first place, the research setting is a longitudinal case study regarding four major players in the higher education market for Learning Management System (LMS) (or virtual learning environment). As software-borne products are featured by frequent upgrades and constant improvement on product attributes over time, sampling in the industry of LMS is thus considered as appropriate theoretical sampling (Glaser and Strauss, 1967). Moreover, selecting cases within one industry also helps to screen out extraneous variation (Eisenhardt, 1989; Gilbert, 2005).

The two-decade longitudinal perspective is taken because this research is set up to interpret the holistic shaping process of overshooting and the disruptive process consequent to overshooting. The process through which overshooting is caused and the process for the varied consequences of overshooting to take shape are important to be explored so as to achieve a holistic understanding of overshooting. Prior studies unsupportive of the existence of overshooting tend to investigate the phenomena of overshooting solely from demand level (Klenner, Hüsig and Dowling, 2013; King and

Baatartogtokh, 2015; Guo *et al.*, 2019). However, this research will involve the analysis from supply level to ascertain overshooting. The reason for the dual levels of analysis is because a phenomena can be better ascertained from multiple perspectives and prior researches combining supply and demand perspectives tend to advance the theory of overshooting or disruption (Henderson, 2006; Chen, Reilly and Lynn, 2012; Lukas *et al.*, 2013; Vecchiato, 2017; Christensen *et al.*, 2018). To involve the multiple perspectives into analysis, case study method is appropriate for it reveals the patterns of processes by clarifying the intricacy of multiple influencing factors (Siggelkow, 2007a).

Another reason to investigate into LMS market is because the LMS market may represent as 'extreme case' for observation (Ozcan, Han and Graebner, 2017). The case setup is that an incumbent was encroached by three disruptors due to the incumbent's overshooting over a timespan of two decades since incumbent's inception to the end of the data collection for this research in the year of 2018, which represents the extreme or polar cases (Pettigrew, 1990) to make the problem of overshooting more "transparently observable" (Eisenhardt, 1989 p.537).

The case studies regarding the four LMS companies will be analyzed on the first place as four independent case studies. The reason for the within-case analysis is to let the theoretical patterns of each individual case naturally emerge without being biased by preconceptions or cross-case comparison (Eisenhardt, 1991) and demonstrate the changes of research focus (Ozcan, Han and Graebner, 2017). The within-case analysis process is mainly in the principle of grounded theory so as to ascertain the new themes,

theoretical patterns, finer categories of construct and intervening circumstances of overshooting and its contextual factors (Corbin and Strauss, 2008). All those emergent themes, constructs and categories will be compared and the comparison will be conducive for *"illuminating and extending the relationships of the constructs"*(Eisenhardt & Graebner, 2007 p.27).

After within-case analysis, cross-case analysis will be conducted based on comparative logic (Eisenhardt, 1991). The overshooting of incumbent product and its consequent disruption by three disruptive products serve as three units of analysis for comparative analysis. The purpose of comparing different unit of analysis is to enhance the external and internal validity of new constructs or theories through repetitive logic (Eisenhardt and Graebner, 2007; Yin, 2017). Particularly, a theory may become more reliable if there is a unit of analysis or case does not literally support theoretical propositions but logically support them (Christensen, 2006a; Yin, 2017). Moreover, a theory or construct could still be improved if the compared units of analysis or cases are not confirming with each other. The reason for it is because "the theory-building process occurs via recursive cycling among the case data, emerging theory, and later, extant literature" (Eisenhardt and Graebner, 2007 p.25). A disconfirmation between cases or units of analysis may only imply the need for another cycle of comparison to generate an improved construct or theory aligning the conflicting case data or theories.

In contrast with the case studies that are purely grounded on data (Glaser and Strauss, 1967), the theories of this research are partially generated under the theoretical lens of path dependence process (Schreyogg and Sydow, 2011). The rationale is that taking a

theoretical lens helps to make researchers aware of the constructs critical for theoretical development, which will clarify the focus of data collection and facilitate researchers' measurement of constructs (Eisenhardt 1989, p.536). Moreover, taking a theoretical lens adds to the chance of theory-building success for the theoretical lens can be used as "*theoretical constructs to case evidence in order to interpret the findings*" (Chieh, Garnsey and Ruan, 2015 p.86). In nature, taking a theoretical lens is an abductive process of embedding a deductive portion into the inductive process of theory development because the theory of path dependence process is deducted to be related to the underlying structures and mechanisms of the antecedents of overshooting – persistent improvement.

Moreover, the deductive portion will complement researchers' inductive efforts in building up a normative theory. According to Christensen's contention (2006), A normative theory should not only delineate cause-and-effect but also include the circumstances upon which the cause-and-effect would hold up. However, almost twenty years after the introduction of the construct of overshooting and its consequent disruptive innovation (Christensen, 1997; Christensen *et al.*, 2018), the construct is still against certain qualitative observations (King and Baatartogtokh, 2015). The conflicting observations may imply that a pure inductive approach may still be hard to capture the hardly observable circumstances making the 'overshooting-disruption' relationship valid. Therefore, this research resorts to deducted theoretical lens and other deductive themes to make the hardly observable circumstances more explicit for observation. In return, the observed circumstances or case data will illustrate the

inducted theoretical lens and themes so as to strengthen their internal validity and avoid speculation (Eisenhardt, 1989; Siggelkow, 2007a).

Apart from the theoretical lens, prior theories of other researchers relevant to overshooting and disruptive innovation are also applied to interpret the evidences of case studies. Those prior theories will act as the preconception regarding the research questions to triangulate and compared with the emergent patterns or themes from case studies. The triangulation will help to further build up and extend prior theories (Sekaran and Bougie, 2010), so the data analysis is not a pure grounded process for this research (Strauss and Corbin, 1990). This research also agrees that considering preconception or taking theoretical lens are different from taking assumptions into theory-building process for the lens and preconceptions of building theory can be rejected whenever it appears not to be in line with data (Siggelkow, 2007a).

The abductive design of research is considered particularly appropriate for this research for overshooting is a slowly developed research field. As discussed in the last section, the construct of overshooting was proposed many years ago in 1997 (Christensen, 1997). Since then, the construct of overshooting was tested and questioned by in a couple of researches (Sood and Tellis, 2010; Klenner, Hüsig and Dowling, 2013; King and Baatartogtokh, 2015; Christensen *et al.*, 2016; Guo *et al.*, 2019). However, people's knowledge regarding the construct of overshooting is still the same as it was in 1997 (Christensen *et al.*, 2018). The slow progress implies that the phenomena of overshooting is neither easily observable through a pure inductive process nor easily deductible from existing theories. Therefore, this research sorts to an abductive process

both in within-case and cross-case analyses to approach to the truth of overshooting. In that process, the deductive part is the preconceptions in Figure 2 while the inductive part is the case analyses based on grounded theory and repetitive logic (Glaser and Strauss, 1967; Yin, 2009).

### 3.4. Sampling Strategy

The informants are purposefully sampled according to research objectives. The research objectives are to better understand the decomposed dimensions of overshooting and their irrespective antecedents and consequent disruptions, the mechanism of becoming ambidextrous at disruptive and incumbent performance dimensions for disruptive product, different antecedents and consequent disruptions of overshooting over time and their coping strategies. In order to accomplish the objectives, key informants are sampled to meet the theoretical definition of overshot customers, company who provides overshooting products and companies who take the advantages of incumbent's overshooting to make disruptive innovations (Christensen, 1997).

The sampled cases for cross-case analysis are four major LMS companies in the higher education sector. Since the year of 1997, Blackboard LMS has been improved in term of its numbers of features and functions, the strategic improvement on LMS features and functions received initial market success for a couple years but later overshot customers in the higher education sector as 'feature creep' (Empson, 2012a). The up and down of customers satisfactions brought about by the persistent improvement on

the certain characteristics of product satisfy the definition of overshooting and hence the selection of LMS industry as theoretical sampling (Glaser and Strauss, 1967). Also, the two-decade case of Blackboard LMS will present as an extended observation towards why and how the improvement on certain performance characteristics of product may lead to overshooting and consequent disruptions over time.

The LMS industry was chosen also because of the dynamic disruptive innovations within the industry. Over the past two decades, the LMS industry in the American, British and Canadian higher education markets had been characterized as the trend of losing market shares from incumbent Blackboard LMS to three rival LMS which were Moodle, Desire2Learn and Canvas (Green, 2010, 2012; Edutechnica, 2018a; ListedTech, 2018). The trend was more obvious in America and Canada than in Britain due to the different paces of market evolution, but the general trend held up in the three countries. The three rival LMS served as different disruptive products emphasizing different performance characteristics of the same product category, so the disruptive dynamics provide as salient phenomenon to be observed about why and how disruptions are consequent to overshooting (Siggelkow, 2007a).

Particularly, Moodle, Desire2Learn and Canvas LMS all served as disruptors encroaching into the mainstream market and the markets peripheral to the mainstream markets of the incumbent Blackboard LMS (Raadt, 2012; Sakoda and Viswanathan, 2012; Tate, 2018). Therefore, the three LMS are selected as the samples to illustrate the mechanism through which the mainstream-market and peripheral-market disruptions are consequent to the decomposed dimensions of overshooting. The same rationale also

explain about why some other widely-adopted LMS, like Sakai, Google Classroom, eCollege and ANGEL learning are not sampled because they either saliently disrupt into the mainstream market or the peripheral markets of the incumbent Blackboard LMS in the higher education sector (Hill, 2019).

Correspondingly, the decomposed dimensions of overshooting, compromised performance and nonabsorbable performance, will be better understood by looking into the mechanism for the overshot customers from the mainstream and peripheral markets of Blackboard left for Moodle, Desire2Learn or Canvas LMS. When the decomposed dimensions of overshooting are clarified, the antecedents and consequent disruptions of the decomposed dimensions of overshooting can be ascertained as well.

While theoretical sampling helps to extend or discover theories, cross-case analysis aims at certain generalizability of the theories based on case data (Eisenhardt and Graebner, 2007). In order to ensure the generalizability, sampling was based on one industry so that the theoretical outcomes were not biased by industrial differences. Moreover, as America, Britain and Canada all displayed the same trend of market evolution of LMS in the higher education sector, the theoretical development would not be biased by country differences too. From another perspective, if the phenomenon of overshooting and disruption of LMS industry somehow overcome country differences to exist, LMS industry could be ideal as natural experiment setup to be sampled.

Also, the sampled LMS cases include two proprietary LMS and two open-source LMS which were welcomed mostly by different market segments, which provided research

settings with enough similarities for comparison while maintained enough dissimilarities for generalizability (Andriopoulos & Lewis, 2009 p.698). In other words, the emergent patterns or themes will not be biased by the varied market segments targeted by LMS or LMS business models, which enhances the generalizability of the emergent patterns or themes.

However, 'four' as the number of sampled cases may not be perfectly justifiable due to the limited number of repetitive cases to generalize the emergent patterns or themes (Eisenhardt and Graebner, 2007). Nevertheless, the number of cases for case study research may not be certain and depends a lot on the how serious the emergent patterns from cases violate existing theories (Siggelkow, 2007a). As discussed in the literature review chapter, the decomposed dimensions of overshooting are obviously violating the traditional view of overshooting. The obvious violation may serve as the 'black swan in a batch of white ones' to propose as valid theoretical propositions to modify existing theories in spite of the limited number of the 'black swans.

Also, this research sets up to develop a theory on the interplay between the supply and demand factors shaping overshooting and leading to disruption. The intricacy of multiple factors present as a complex process which cannot be holistically and systematically investigated if too many sampled cases are included (Ozcan, Han and Graebner, 2017). On another side, as a single case between Blackboard's overshooting and Canvas' disruption may adversely affect the generalizability of the emergent theories, the comparison across the cases of Blackboard's overshooting versus three rival LMS' disruption will replicate and consolidate newly emergent theoretical

patterns (Yin, 2009). To make the balance between single-case and multiple-case studies, this research sampled four companies to compose the limited number of cases embedded in the longitudinal case of Blackboard.

The dual levels of analysis between supply and demand factors require the informants to be sampled from the case companies as well as the markets served by them. For the internal staff of those LMS companies, the CEOs, founders and directors of marketing or R&D department were selected as informants because of their access to key decision-making information (Thrane, Blaabjerg and Møller, 2010). The reason for the selection of top management and marketing or R&D departments was because people from top management and those departments were found to be most influential on the strategic orientation of innovation – either market-oriented or technology-oriented (Han, Kim and Srivastava, 1998; Danneels, 2002; Slater and Mohr, 2006; Lamore, Berkowitz and Farrington, 2013). Also, management's perceptions towards organisational change were usually considered as important given the critical position of management in directing organisation development (Daft and Weick, 1984).

From the market side, product feedbacks from certain higher education institutions in America, Britain and Canada were collected. The key decision-makers of LMS purchase were teaching faculty, IT administrator and students. Taking Missouri University based in America for example, its purchase decision was based on the aggregated results from LMS vendor presentations to the evaluation committee composed by teacher, students and IT technicians, technical and feature evaluation from IT administrators as well as focus group and surveys with faculty and students

(University of Missouri, 2015). Procedurally, several selected LMS vendors were initially called on for a presentation to the evaluation committee of the university for further selection. Afterwards, a pilot of the selected LMS would be conducted with a sample of students, teachers and IT administrators. Finally, interviews, focus groups and surveys would be conducted to glean the feedbacks from the pilot. However, the weights put on different key decision-makers may vary across institutions for some institutions may emphasize campus-wide IT administration while other may attach more importance to teachers or students.

The major sources of data are based on a great many of secondary data regarding teachers, students and IT administrators as sampled informants. However, to achieve a balanced view of customer feedbacks, IT administrators, teachers and students of different educational institutes were contacted for interviews (see interview guide in the Appendices section). To aid comparison between the product attributes of different LMS companies. The selection of users was inclined to those with experiences of using more than one LMS or ever contribute to the decisions to switch from one to another LMS. Particularly, users with experiences of historical versions of the LMS offered by different companies were preferred.

As an intention to access more informants about the overshooting and disruptive innovation, a snowball technique was used to bring in other secondary data or new informants to be accessed apart from those key stakeholders, which means the whole process of research also involves "*an iterative process seeking new informants on the basis of information deemed important by prior informant*s" (Corley & Gioia, 2004

p.180). Also, the initial theoretical relationships developed from the prior informants can be then validated by the later informants selected based on the snowball process, which was also a triangulation process to ensure a more bias-free understanding towards the problem of overshooting in the context of disruptive innovation.

### 3.5. Data Generation

Case study researchers tend to triangulate different data collection methods (Siggelkow *et al.*, 2001; Gilbert, 2005; Seidel, 2007; Chieh, Garnsey and Ruan, 2015). "*The rationale is the same as in hypothesis-testing research. That is, the triangulation made possible by multiple data collection methods provides stronger substantiation of constructs and hypotheses*" (Eisenhardt, 1989 p.538). However, the validity of constructs or hypotheses are not only achievable through the triangulation of different data collection methods but also through the triangulations of different data sources, different data collectors and different theoretical perspectives (Sekaran & Bougie, 2010). While the triangulation through different theoretical perspectives has already been discussed in the research design section, this section depicts the data generation of this research based on the rest of the forms of triangulations.

Case data was mainly obtained from secondary sources. Firstly, the composition of secondary data features the triangulation of different data collection methods. Secondary data were generated by people mainly using methods which were interviews conducted by well-known medias reporters, public/archival documents from sampled

companies and higher education institutions, LMS pilot surveys and focus group conducted by different universities, market reports and surveys released by industrial research companies and government agency (see Table 6). The previously reported interviews were conducted with the founders, CEO and directors of product development and marketing departments of the sampled companies, articles from various well-known medias including Inside Higher Ed, Forbes, Edsurge and TechCrunch, publicly available reports from financial institutions, industrial research companies and free-lance industrial analysts, LMS pilot reports were released by various higher education institutions from America, Britain and Canada, and archival data were from the blogs of founders, CEO and department directors of sampled companies, historical product releases, customers acquisition, merger and acquisition announcements. Further details of the data composition are summarized in Table 6.

**TABLE 6: Secondary Database Composition**

| Document Type | Proprietary LMS companies: **Blackboard and Desire2learn** | Open-source LMS companies: **Moodle and Canvas** |
|---|---|---|
| Interviews Conducted by Reporters from Well-known Medias<br><br>(*34 documents*) | Interviewees include:<br>Matthew Pittinsky - Co-founder and Former Board Chairman of Blackboard, Inc;<br>Michael Chasen - Co-founder and Former CEO of Blackboard, Inc;<br>Phil Miller - Chief Learning and Innovation Officer at Blackboard, Inc;<br>John Baker – Founder and CEO of Desire2Learn. | Interviewees include:<br>Martin Dougiamas – Founder and CEO of Moodle Pty Ltd;<br>Brian Whitmer – Co-founder and Former CPO of Instructure, Inc;<br>Josh Coates – Co-founder and CEO of Instructure, Inc. |
| Articles & Archives<br><br>(*183 documents*) | Articles written by different reporters and analysts as well as internal archives about the product strategy, customer feedback and market competition of different LMS companies. Reporters are coming from well-known medias including Inside Higher Ed, Forbes, EdSurge, Techcrunch and the like. Analysts are all long-term observants in the LMS industry. Articles also include the blogs authored by the top management or founders of the selected LMS companies. The archival | |

| | |
|---|---|
| | articles are collected from the official websites regarding product press releases, historical customer acquisition, and strategic changes. |
| LMS Pilot Reports<br><br>(*46 document*s) | LMS pilot reports are released by various higher education institutions when they come to pilot different LMS and make decisions about the LMS they switch to. |
| Market Reports & Surveys<br><br>(*27 documents*) | Market reports and surveys mainly come from three industrial research projects regarding LMS market in the higher education sectors of USA, Canada and UK:<br>1） Edutechnica http://edutechnica.com/about/<br>2） Listedtech https://www.listedtech.com<br>3） Campus Computing Project https://www.campuscomputing.net |

Secondly, different forms of secondary data were sourced from realities constructed by different people. From the supply side, the interviews conducted by different reporters with the founders, CEO and department directors of the sampled companies were triangulated with the publicly available company archival and reports from well-known medias to know how overshooting products and disruptive products were made by the sampled companies at different points in time. From the demand side, LMS pilot reported by different higher education institutions were triangulated with market reports and surveys as well as media reports from industrial researchers and analysts to understand customers' perception of overshooting and their decisions to switch to disruptive products. Nevertheless, the supply and demand sides are not mutually exclusive but corroborated each other for the newly developed constructs or theoretical hypotheses in this research.

Additionally, the data of different sources produced at different points in time were collected. The information of the LMS pilot reports from a dozen of institutions may

tell about the purchase decision-making factors including organisational budget, technical issues or other specific concerns at different points in time spanning from 2003 to 2018.

However, those reports would not cover the complete time horizon of the evolving markets served by sampled companies over the two decades since 1997, so publicly accessible data including articles from business press, reports from consultancy and financial analysts, previous case studies, and historical annual reports were collected to analyse the historical evolution of markets. Also, the collected documentation were used to corroborate the information secured from interviews as well (Gibert 2005 p.745). Additionally, company archives regarding corporate strategy, organisation structure, technological investment and change, and human resources were selected to collect so as to track the evolution of sampled companies from their inceptions to the year of 2018 (Tripsas and Gavetti 2000 p.1149).

Collecting the data generated at different points in history helps to formulate real-time case. "*Real-time cases employ longitudinal data collection of interviews and, often, observations, both of which help to mitigate retrospective sensemaking and impression management*" (Eisenhardt and Graebner, 2007 p.28). Although it was impossible to go back in history to observe what really happened, the interviews and various documents produced at different points in history helped to mitigate the likely retrospective sensemaking from the interviews of primary source.

**TABLE 7: Interviewees' Backgrounds**

| *Interviewees' Role* | *Interviewees' Affiliation* | *LMS ever used* |
|---|---|---|
| E-learning Director | Russel Group University in the UK | Blackboard |
| E-learning Director | Post-1992 University in the UK | WebCT & Moodle |
| E-learning Officer | Russel Group University in the UK | Sakai |
| E-learning Head | Russel Group University in the UK | Moodle |
| Undergraduate Student | Post-1992 University in the UK | Moodle |
| Postgraduate Student | Russel Group University in the UK | Blackboard |
| Professor | University based in the Cantonese Province of China | Blackboard |

Before the secondary data were collected, the primary interviews had been conducted to triangulate with and inform about secondary data sourcing. Seven interviews were conducted (see Table 7) in total including four with the e-learning directors of three Russell Group universities and one post-1992 university in the UK, two interviews with one student with Moodle user experience from a post-1992 university and one student with Blackboard user experience from a Russel Group university in the UK, and one interview with a Professor with Blackboard user experience from a university based in the Cantonese province of China. The number of interviews is limited due to inaccessibility to a larger number of interviewees within a short span of time and the exploratory nature of primary data to inform the collection of secondary data up to a much larger scale later.

The e-learning staff, teacher and students of universities were selected because they tend to jointly make the decisions regarding which LMS should be purchased. However, their importance attached to the purchase decision-making have been varying over time. Although teachers and students were always been given the opportunity to express their preference over which LMS to use, the importance of teachers and students were weighed increasingly against IT administrators over time in the American higher

education sector. The reason was because teachers and students were yet to be familiar with LMS in the initial decade of LMS development in mass market since 1997 whereas the decade thereafter favoured teachers and students as increasingly important decision-makers of purchase (Hill, 2018a). The number of interviews was determined purely by the accessibility to interviewees.

The approach of the interview was semi-structured, which meant demographic and open questions were fixed while probing questions were improvised on the spot to "explore responses that are of significance to the research topic*"* (Saunders, Lewis, & Thornhill, 2012 p.392). To be specific, interviews with the internal staff of sampled company were targeted at the information regarding which attributes of product were persistently improved by them, why certain product attributes were improved persistently, what motivated staff to improve those product attributes, how that commitment changed over time, how customers responded to their persistent efforts over time, how staff from marketing department promoted products and made sales, how marketing intelligence worked to learn customer preferences and what decision-making process was implemented regarding product innovation. Interviews with the e-learning directors at different universities were aimed at figuring out why certain LMSs were adopted or replaced, what the advantages and disadvantages of the adopted LMS were in comparison with other alternatives, how the advantages and disadvantages had evolved as product upgraded over time, which product attributes were mostly needed to improve over time, to what extent had the adopted LMS been improved to meet the needs over time and to what extent universities were willing to pay for product upgrades.

Those questions were derived from either literature review or secondary source of data so as to achieve triangulation.

An interview guide was used to lead the interview process (see Appendices). Interviews will begin with questions are like "what is innovation? Where does it take place? how does it take place?". Those preluding questions were brought up to secure intuitive responses reflecting on their ingrained cognition about innovation in terms of LMS. The questions works as nondirective questioning to reflect which aspects of LMS have been emphasized and constantly improved in the minds of different stakeholders. The answers to those questions will be triangulated with the directive questioning regarding what performance dimensions of product have been constantly improved.

Afterwards, questions were directed at some of the preconceptions in Figure 2. From demand side, in order to find out what is overshooting, questions were formulated for IT administrators, teaching faculties and students are what has the LMS performance characteristics been constantly improved? How does the current version of LMS compares to previous version? Any aspects of LMS are doing well or not? From demand side, questions included those regarding the antecedents of overshooting, like what drives the persistent efforts of improving certain performance characteristics? and those about the consequent disruption to overshooting, like what are the next disruptive force to current LMS?

However, not all preconceptions in Figure 2 were considered for questions formulation. The reason is largely because the case analysis and data collection of this research were

following a reiterative process(Eisenhardt and Graebner, 2007). In that process, interview data based on some preconceptions were collected and analysed initially, which informed about more emergent themes and preconceptions from literatures to extend Figure 2. Those themes and preconceptions would inform another round of data collection from secondary sources which composed most of the data for this research.

In that reiterative relationship between the data sources of interview and document, two benefits were pursued. For one, the reiterative process reflects the intertwined process between data collection and data analysis in case study research (Eisenhardt, 1989; Sobh and Perry, 2006a); For another, the initial interviews worked as pilot or exploratory data collection process to inform and improve the secondary data collection later, which made the secondary data collection more accurate and answerable to research questions.

However, given the more piloting or exploratory nature of the initial interviews and limited timescale, the secondary source of data was not possible to be further confirmed by another round of primary data sourcing, like more interviews with refined questions based on secondary data, as two-stage process of interviews (Sobh and Perry, 2006a). Consequently, it may cause bias since the secondary data were not initially generated for the purpose of this research and were not later checked for validity through stage-two interviews.

In the middle of asking those pre-set questions, probing questions sometimes spoke in to explore further about the aspects related to the theoretical lens of path dependence

and the consequences of overshooting, which were developed as prior concepts in the literature review. However, the questions specifically asked on the spot varied slightly from those pre-set in last paragraph. The variation was due to the fact that some issues were worthwhile to probe further or needed clarification.

### 3.6. Data Analysis

**Within-case Analysis**: the analyses for this research applied comparative logic as the basic analytic tool (Eisenhardt 1991). The comparative logic means to develop and extend theory through comparing different units of analysis embedded in a single case or different case. The comparative logic is a universal tool for theory generation and it can be applied not only within a single case (Yin 2017; Eisenhardt 1991) or cross different cases (Eisenhardt 1989), but also for a category of theme (Corbin and Strauss, 2008). The application of comparative logic at category level means to use systematic comparison between two or more phenomena so as to determine the dimensions and properties of a category of phenomenon and its relationship to other categories of phenomena, which is essentially the first step of grounded theory. Grounded theory is suitable for conducting within-case analysis for it assembles data to support important categories or constructs which are the foundations for further inductive analyses.

The approach of grounded theory compromises three steps which are open coding, axial coding and selective coding (Corbin and Strauss, 2008). However, this research did not fully implement open coding for which means to induct theory from data without any

preconception. As this research intended to balance with prior researches regarding overshooting, the open coding process involved the prior theories/theoretical lens in Figure 2 as existing categories and codes so as to build up and extend existing theories (Sekaran & Bougie, 2010). Nevertheless, the codes and categories emerged from both primary and secondary sources of data were also taken into consideration for later axial coding.

In the step of open coding, data of interviews and documents were coded into the categories according to the theoretical lens or prior concepts developed from literature. To be specific, broad categories like meta-routine, self-reinforcement and organisational lock-in were considered as the likely causes of overshooting product attributes in the literature review, secondary data and interview data from Appendices conforming to those broad categories will thus be labelled under those categories. Also, preconceptions in Figure 2 suggests that the consequences of overshooting certain performance characteristics of product are trade-off-reversing disruption and trade-off-breaking disruption. Therefore, secondary data and interview data from Appendices were coded into the categories regarding the consequences of overshooting product performances in the open coding process. However, for those data cannot be coded into existing categories, new categories were developed for theory extension (Sobh and Perry, 2006b).

In the axial coding process, the relationships between categories or subcategories were identified (Corbin and Strauss, 2008). As data have all been coded into the categories as identified in literature review or new categories emerged from data, normally a

further examination should will be done to determine the relationships between categories and subcategories (Strauss and Corbin, 1990). However, as this research have already identified the relationships between different preconceptions as categories in the Figure 2, the identified relationships would be applied into the axial coding process to define the relationships between categories. The application of an existing relationship framework into the case data is not new for axial coding, grounded theory researchers also apply a predefined 'coding paradigm' as the relationship framework for different categories into axial coding process so as to find out the conditions under which and the process through which those categories emerge and their consequences (Strauss and Corbin, 1990). Coincidently, the relationship framework in Figure 2 was also organised to reflect the antecedents and consequences of overshooting, so the relationship framework was used for axial coding. Again, the relationship framework would be amendable according to the emergent patterns from case data.

After that, those categories and their relationships identified in the open and axial coding were put together to analyse their relationships to the central category in the selective coding process (Strauss and Corbin, 1990). In order to ensure the natural emerge of theoretical pattern and clarify relationships between central category and other categories, a time-line relationship framework between the central category – overshooting and other categories was presented at the end of within-case analysis. As the relationship between categories of antecedents, overshooting and consequent disruptions in Figure 2 were consistent with chronological order, the timeline presence of the relationships between overshooting as central category and other categories could

be a justifiable selective coding process. However, in line with open and axial coding, the timeline relationships were modifiable if data tell a different story.

Within-case analysis of this research was featured as the comparison between the preconceptions in Figure 2 and the categories grounded on case data. However, the feature put this research in doubt about if grounded theory approach was truly adopted. That explains why certain case study researchers propose to avoid the use of the term – grounded analysis (Eisenhardt and Graebner, 2007), particularly when researches are impossible to have nothing in mind as they come to analyse case data (Siggelkow, 2007b). However, this research considers that the value of grounded theory does not only lie in its adherence to data through open coding but also in its clarification of the circumstances or conditions upon which a theory or a category may hold up by linking circumstance-based categories to a theory or category through axial and selective coding (Christensen, 2006 p.44). Therefore, the approach of grounded theory was used in combination with preconceptions in Figure 2 to arrive at a more balanced reality for one and to specify the circumstances under which overshooting and disruption may happen for another.

**Cross-case analysis**: Eisenhardt's cross-case analysis (1989) was applied to identify similarities across different units of analysis for this research. Blackboard's overshooting and its consequent disruptions by Moodle, Desire2Learn and Canvas will serve as three units of analyses for comparison. Those preconceptions in Figure 2 and categories and relationships grounded on case data were used as the dimensions for the comparison across different units of analysis (Eisenhardt, 1989). Once a preconception,

category or relationship was literally or theoretically repeated or confirmed by the three units of analysis, the preconception, category or relationship would be proposed as new construct or theoretical proposition (Yin, 2017).

To be specific, Blackboard vs Moodle, Blackboard vs Canvas, and Blackboard vs Desire2Learn served as three units of analysis to be compared with each other through the theoretical lens of constant routine, self-reinforcement and organisational lock-in. The comparison added rigor to the theoretical propositions developed from within-case analysis and extend theory if cases do not conform to each other. For those constructs and theoretical propositions confirmed by cross-case analysis, tables were presented to display evidences supporting the constructs or theoretical propositions (Miles and Huberman, 1994).

It is worth to note that this research only displayed evidences based on the repetitive logic of cross-case analysis (Eisenhardt and Graebner, 2007; Yin, 2017). However, this research did not display different sources of data from any single unit of analysis to support one construct. For example, the construct 'Mission Perception' was only supported by founder's interview data but not from the data of different sources as suggested by Eisenhardt (1989). Failing to cite different sources of data to support constructs was due to the restricted timeframe and limited resources to analyse and display data of different sources, which may undermine the internal validity of new constructs. However, this research made up for this shortage somehow by supporting new constructs with the data across different units of analysis. Also, the constructs based on simplified variety of data sources made it possible to display the causal

relationships between different constructs within one table, which alleviated the trade-off between better theory and better story (Eisenhardt, 1991)

### 3.7. Data Saturation

This research mainly uses 'iterative process' to ensure data saturation, which is "*an iterative process of simultaneously collecting data, analysing the data, and seeking new informants on the basis of information deemed important by prior informants. This approach resulted in an evolving sample of informants and increasingly focused data relevant to the emerging theory, until further data collection and analysis yielded no further explication of a given category or theme"* (Corley and Gioia, 2004 p.180).

The iterative process embodies itself in three aspects of this research: firstly, data collection process is iterative, which means going back and forth between collection and analysis of within and cross different streams of data until further data collection generates incremental addition to emergent patterns; secondly, analytical process is iterative, which means the within-case analysis, cross-case analysis, demand and supply levels of analysis, prior theories, deductive themes and grounded analysis triangulates with each other until no radical changes can be made to emergent themes and categories.

Finally, the within-case analysis section of this research "*create in depth case histories, which is a straight forward way to organize a large amount of data in a descriptive fashion (Eisenhardt, 1989). Researchers can add data to a running description of their case, helping to increase familiarity with the case as data collection and analysis*

*proceeds. Also, the emerging case history may help researchers notice gaps in data collection or potential changes in research focus*" (Ozcan, Han and Graebner, 2017 p.16). Therefore, both the familiarity with case data and the noticed gaps in changes of research focus will contribute to data saturation.

### 3.8. Ethical Consideration

Ethical consideration should reflect the specific contexts of the research aims, samples and process of this study. Ethical conduct in the case studies can vary but generally share certain aspects (Farquhar, 2012): first, the participants of research should have the autonomy to opt in or out of the research at any stage; second, confidentiality should be kept for organisations or people concerned; third, research process and outcomes should be transparent and positive. On top of those universal codes of ethical research, ethical considerations should also be context-specific for "*research ethics is a branch of applied ethics focused on the specific contexts of planning, conducting, communicating, and following up research*" (Punch, 2005 p.36). On those grounds, the contexts of this specific study also imposes ethical disciplines on the courses of research actions.

To be specific, the context of this study is about the practice of overshooting in the context of Learning Management System innovation. This context attaches importance to several ethical concerns. In the first place, part of the data in this research were sourced from the interviewees in universities or companies. Therefore, informed

consent would be secured from the interviewees before interviews. Also, this research identified the e-learning officer of higher education institutions as the key contact for interviews because of their responsibility for daily LMS maintenance, so extra considerations are thus given to e-learning officers with regard to the complexity of their position, like their working hours (Punch, 2005). Moreover, as this research concerns the competitive environment of virtual learning environment market, pseudonyms were used for the sampled interviewees from the companies and universities involved in this research (Saunders, Lewis and Thornhill, 2012).

In addition to the context-specific ethical conduct, the whole process of research employed ethical considerations throughout. When participants were contacted, they were informed initially about the purpose, timescale and benefits of research. Afterwards, informed consent was secured prior to interview and all interviewees were anonymised. In addition, contact information for the researcher and his supervisors were provided to protect participants' autonomy while participating in the research. Data collected were kept confidential to avoid access outside of the supervisory team of this project. At the end of the project, an electronic copy of the research outcomes was sent to the participated interviewees who may benefit from the project. In spite of all these ethical considerations, extra ethical actions will be conducted whenever the research may cause harm to participants.

## 3.9. Conclusion

This chapter mainly expounds the research design and data analysis based on the paradigm of critical realism (Sobh and Perry, 2006). Critical realists do not generalize newly developed theories to a statistical population but generalize to prior theories (Yin, 2017). In order to generalize newly emerged theories to prior theories, the emerged theories needed to be triangulated with prior theories and other different perceptions based on data to achieve a balanced view of reality. Apart from triangulating with prior theories, this research also used theoretical lens to develop new theories. In nature, taking theoretical lens helps to uncover the underlying structure and mechanism of the phenomenon in related to the antecedents of overshooting. Therefore, the final theoretical outcomes of this research were the synthesized comparison of emergent theories from data, theoretical lens and prior theories. The data sources were largely from secondary data but which were triangulated with first-hand data achieve the better validity of new constructs and propositions.

When data were collected to compose case studies, within-case analysis was presented in timeline manner to ensure the natural emergence of theoretical patterns before cross-case analysis set in. Within-case analysis compared the preconceptions in Figure 2 with the categories grounded on case data (Corbin and Strauss, 2008). Afterwards, cross-case analysis was conducted to validify new constructs and theoretical propositions based on repetitive logic (Yin, 2017). Finally, the new constructs and theoretical propositions were tabulated with selected case data to display (Miles and Huberman, 1994). The specific presentation of case data and analyses are in the next chapter.

# 4. CHAPTER FOUR: ANALYSES AND RESULTS

## 4.1. Introduction

How can product improvement hit the sweet spot of customers – good enough but not too good to overshoot the needs of customers? The analyses and results in this chapter will give implications to this managerial question and other research questions aforementioned.

In this chapter, within-case analysis is presented before cross-case analysis and "*this process allows the unique patterns of each case to emerge before investigators push to generalize patterns across cases*" (Eisenhardt, 1989 p.540). However, the cross-case patterns already emergent from within-case analysis will be discussed before cross-case analysis. In the latter section of this chapter, cross-case analysis will be conducted to further build up theories by finding out theoretical patterns holding up across units of analysis.

Both theoretical propositions and their supported case data will be tabulated together in the cross-case analysis section to strike the balance between theory and story (Eisenhardt, 1991; Gibb, Alan and Kathleen, 1991). As a result, the emergent theoretical patterns will be less buried in the case data for cross-case analysis than in the chronologically presented case data for within-case analysis, which is to facilitate readers' familiarity with case data before theoretical emergence (Ozcan, Han and Graebner, 2017) and hence more transparency. However, the emergent patterns will be more evidently categorised, synthesized and extracted from case data at the end of each

unique case so that both analytical process and theoretical patterns will be more explicit in the within-case analysis section.

**TABLE 8: Analytical Process and Data Source**

| Data Analysis | 1st Order Analysis (open coding) | 2nd Order Analysis (axial coding) | 3rd Order Analysis (selective coding) |
|---|---|---|---|
| ***Within-case Analysis*** | Categorizing against Certain Preconceptions | Categorizing against Figure 2 as Coding Paradigm | Synthesizing Categories to Demand Level of Analysis |
| ***Cross-case Analysis*** | Comparing across Cases against Certain Preconceptions | Comparing across Cases against Figure 2 as Coding Paradigm | Synthesizing Categories to Supply Level of Analysis |
| Data Sources*:*<br>● *Primary interviews with E-learning Officers from different British universities;*<br>● *Secondary interviews conducted by reporters with key informants and their blogs;*<br>● *LMS pilot reports conducted by different institutions;*<br>● *Market surveys and reports released by industry consultancy firms;*<br>● *Archives, product releases and press releases from sampled LMS companies;*<br>● *Analytical articles from industrial analysts and observants;*<br>● *Articles from Well-known magazines and newspapers including Inside Higher Ed, Forbes, EdSurge, Techcrunch and the like.* | | | |

Despite the different data presentation for within and cross-case analysis, their analytical processes or orders are largely the same. The above table summarizes about the data used for analysis and the process through which the data are analysed. On first place, all sources of data were organised and presented chronologically for each of the four LMS companies. The emergent themes of each case history were then compared and coded against some of the preconceptions from Figure 2. Afterwards, the emergent relationships between different categories were compared and triangulated with the framework of Figure 2 as coding paradigm to arrive at more valid relationships between categories. Finally, the categories and their relationships were further abstracted to the analysis levels of demand and supply through the selective coding process as the last order of analysis. The following contents will make the presentation of chronological

case data but with analytical themes or categories integrated as theoretical signposts at the end of or throughout case history.

## 4.2. Within-case Analysis

To ensure the unique patterns of each case or unit of analysis to emerge, the cases composed by the primary and secondary data in chronological order were presented on the first place. Afterwards, case data were coded, categorised and organised through the grounded theory approach to arrive at the framework of categories or themes for each case which were illustrated in the figures following each descriptive case. Finally, the cross-case patterns supported by each single case from with-case analysis will be discussed for their theoretical implications at the demand level of analysis.

### 4.2.1. Blackboard Case

Blackboard were facing financial constraints in its founding years. The founders of Blackboard LLC– Michael Chasen and Matthew Pittinsky started the company at a basement of a law firm in Washington in 1997 while they only saved to live for one year (Gibbs Katz, 2010; Heath, 2012). Blackboard LLC sustained itself through the $1.5 million contract given up by KPMG as a consulting firm (Gilus, 2007), there was not a LMS produced within Blackboard in its first year. To save money, Michael and Matthew stole office chairs from their previous employer - KPMG and its CEO of that time – Michael Chasen recalled that "*office space was so tight that at the end of the day, we had to stand the last desk upright in the center of the room in order to leave. The*

*next morning, the last person in turned over the desk, which then blocked the door*" (Chasen, 2009; Empson, 2012a).

In the presence of the humble conditions, Michael Chasen actively reached out to absorb external resources. Michael Chasen ever said in an interview: "*we went to every event we could think of and talked to as many people as possible about our business, and we entered every possible business plan competition*" (Burn, 2006). In 1998, Blackboard LLC merged with CourseInfo LLC to form Blackboard Inc and turned from a company offering consultant service to the one mainly offering Learning Management software for license fee, which helped blackboard to secure $3 million VC investment from Novak Biddle Venture Partners (Pearistein, 2012). In the years between 1998 and 2001, Michael Chasen actively met with investors and secured funding up to $103 million from Dell, AOL, Pearson, Novak Biddle Venture Capital and other famous investors in the IT field (Chasen, 2009; Empson, 2012). Among the investors, AOL, Microsoft, Dell, Person and Kaplan were also strategic partners who could provide resources beyond pure money investment (Burn, 2006).

In the meantime, Dan Cane and Stephen Gilfus, who used to be founders of CourseInfo LLC, were separately in charge of product development and product strategy and marketing inside Blackboard Inc (Gilus, 2007). The product vision or strategy at that time was to turn Blackboard into the operating systems of e-learning market, like Windows or MacOS for personal computers (Pittinsky and Gilfus, 2000). Two years after CourseInfo LLC merged with Blackboard LLC, the LMS of Blackboard Inc was upgraded to its fifth generation while customer base expanded from 15 to 1000 clients

(Gilfus, 2000). Over time, many functions of Blackboard LMS were already typical of nowadays' Learning Management System including course calendar, automatic uploading, discussion boards, campus portal and content management. To increase product flexibility, Dan Cane and Stephen Gilfus developed Blackboard Building Blocks to allow third suppliers to integrate functions and features with its LMS (Pittinsky and Gilfus, 2000).

Apart from internal innovation, Blackboard also begun to actively absorb external innovations through merger and acquisition as Michael Chasen and Mathew Pittinsky took the rein of Blackboard Inc (Gilus, 2007). In the January of 2001, Matthew Pittinsky became the CEO of Blackboard and Mathew Chasen had already been the Chairman of Board since 1997 (Blackboard Inc, 2005a). In 2000, Blackboard merged with its Richmond-based competitor - MadDuck Technologies LLC and acquired AT&T Campuswide and CEI Special Teams which were the ID cards for commerce and security on campus. In 2002, another competitor – Prometheus was acquired and many of its product features were integrated into Blackboard LMS (Licamele, 2002a). In 2003, Blackboard acquired SA Cash which was a subdivision of Student Advantage Inc (Wehr, 2003).

According to Table 9, those merged and acquired products were incorporated into the two product packages of Blackboard: Blackboard Academic Suite and Blackboard Commerce Suite (Blackboard Inc., 2004). The acquired AT&T CampusWide and CEI Special Teams were transformed into the Blackboard Transact which belonged to Blackboard Commerce Suite. The rival learning management systems – MadDuck

Technologies and Prometheus were acquired to integrated into the LMS of Blackboard – Blackboard Learning System which belonged to Blackboard Academic Suite. The acquired SA Cash was later reconfigured into Blackboard One which was part of Blackboard Commerce Suite. Up to the end of 2003, Blackboard products were offered to 2000 clients in more than 50 countries (Blackboard Inc., 2004).

**TABLE 9: Blackboard, Inc's Growth Strategy and Market Expansion**

| Case No.1 | Year | Growth Strategy | | Market Growth | Revenue (In thousands) | Net Profit (In thousands) | R&D Cost (In thousands) |
|---|---|---|---|---|---|---|---|
| | | **Internal Innovation** | **External Acquisition** | | | | |
| Blackboard | 1997 | Start up as a consultant company without tangible products but intangible services | | | | | |
| | 1998 | | Merged with Courseinfo LLC to provide CourseInfo 1.0 and 2.0 | 15 Clients (USA) | | | |
| | 1999 | CourseInfo 3.0 / 4.0 | | 500 Clients (USA) | | | |
| | 2000 | Blackboard Learning System 5.0 (Formally CourseInfo 5.0) | Acquire rival LMS firm - MadDuck Technologies LLC<br><br>Acquired AT&T Campuswide and CEI Special Teams whose product was integrated as Blackboard Transaction System | 1600 Clients (global) | $12,060 | -$30,091 | $8,024 |
| | 2001 | Blackboard Building Blocks™, the first open architecture program | | >1200 Clients (USA)<br>1800 Clients (global) | $46,725 | -$41,785 | $13,207 |
| | 2002 | Blackboard Learning System 6.0, | Acquired Prometheus whose product features was integrated into Blackboard Learning 6.0 | 2600 Clients (global) | $69,946 | -$41,651 | $10,272 |
| | 2003 | BbOne™, a cashless transaction system, launches | | 3000 Clients (global) | $92,478 | -$1,425 | $11,379 |
| | 2004 | Blackboard Content System™ | | 2229 Clients (USA) | $111,403 | $10,049 | $13,749 |

***Data Sources**: Financial Reports of Blackboard, Inc. and Other Archival and Public Documents* (Blackboard, 2004; Blackboard Inc., 2004, 2007; Burn, 2006; Gilus, 2007; Blackboard Inc, 2010).

Although both internal innovation and external acquisition may contribute to market growth, resources inside Blackboard were skewed towards external acquisition. According to the prospectus prepared by Blackboard Inc for IPO in 2004 (Blackboard Inc., 2004), with other cost items, including marketing and sales, cost of product & professional service, general and administrative expenses, remained approximately in proportion to the growth of revenue, the expenses for R&D dropped from 66.5% in 2000 to only 12.3% in 2004 in proportion to revenue. The contracted R&D investment was in contrast with the lavish spending on merger and acquisition. In 2000, $1.2 million cash spent on the acquisition of MadDuck Technologies LLC and $15.8 million cash for buying CampusWide. In 2002, $3 million was borrowed to acquire Prometheus as well as its liability of $550,000. In 2003, $4.5 million cash paid for the acquisition of SA cash. The mergers and acquisitions all happened in the years when Blackboard was yet to break even (Blackboard, 2004).

The unbalanced financial commitment between inside and acquired innovation complemented well with the profit model of Blackboard. In 2000, the marketing expenses of Blackboard Inc accounted for 155.8% of total revenue (Blackboard Inc, 2004). However, its merger and acquisition largely boosted the total revenue of Blackboard by cross-selling existing and acquired products to existing and acquired customers， which partially contributed to lower costs to 36% relative to its total revenue till 2004 (Blackboard Inc, 2004). The revenue generated from the charges on

Blackboard software as license fees also helped Blackboard to survive the burst of the dot.com bubble in the late 90s (Gibbs Katz, no date; Burn, 2006).

The absorption of external innovations intermeshed well with its profit model of charging on the usage of Blackboard software. The more acquired companies into Blackboard, the more revenue growth generated from cross-selling a larger portfolio of products over a broader customer base (Farmer, 2008b). The resultant revenue growth was from $12,060 to $111,403 since 2000 to 2004 (Blackboard Inc, 2004). The ever-increasing revenue were re-distributed to merger or acquisition at a larger extent than internal product innovation to drive further growth (Gilus, 2007). Venture capitals were also attracted to Blackboard for its proved growth and resourceful merger & acquisition, which in return financed further merger & acquisition (G. Gibbs Katz, 2010; Empson, 2012b).

Since Blackboard raised $70 million from NASDAQ , external acquisition was drawn upon continuingly as Michael Chasen proceeded to lead Blackboard (Blackboard Inc., 2004; Empson, 2012b). In the year following the IPO, $180 million in cash was spent for the acquisition of WebCT – the second largest LMS company in the higher education sector, which turned Blackboard into the market leader accounting for 70% market share of the internet-based learning management system (Blackboard Inc, 2005a; Pearistein, 2012). In 2007, Blackboard acquired Xythos Software which was integrated into its Blackboard Content System™. In 2008, a mass notification service provider – NTI Group was acquired, its product was renamed as Blackboard Connect™ in 2009. In the same year, another rising LMS – Angel was acquired by Blackboard. Afterwards,

instead of developing an in-house solution to accommodate the trend in mobile application, Blackboard acquired Terriblyclever to offer as Blackboard Mobile™ in 2009. In 2010, Saf-T-Net was acquired to add to Blackboard Connect™. Additionally, Blackboard also acquired Elluminate and Wimba to create Blackboard Collaborate™, Presidium to create Blackboard Student Services and iStrategy to offer as Blackboard Analytics™ irrespectively in 2010 (Blackboard Inc, 2010).

Blackboard Inc kept an eye on external innovations with promising growth prospect and acted swiftly to acquire and scale them up across its wide customer base. For example, Blackboard was the first major e-learning company to scale up mobile application into mass market. The fast time-to-market enabled Blackboard to capture the growth opportunity in a market of new product category (Stanko, Molina- and Munuera-Aleman, 2012). As commented by Ray Henderson who was previously the president of Blackboard's teaching and learning division that "*Not everything Blackboard created was beautiful, original, nor perfected. But it was often the first out, the most widely known, and packaged with enough of the services and company attributes needed to win against larger but slower companies*" (Henderson, 2012). Up to 2011, All seven product lines of Blackboard Inc were heavily based on external acquisitions (Blackboard Inc, 2010).

However, the dominant strategy of growing though external acquisition crowded out the internal innovations of Blackboard. According to the data from Table 8, from 2002 to 2010, the Research and Development cost never went beyond 14% of the total revenue (Blackboard Inc, 2005a; Blackboard Inc., 2010). Meanwhile, other

components of production cost, including sales and marketing, and General and Administrative expenses, were all kept in stable proportion to total revenue in spite of the acquisitions of WebCT, Xythos and NTI Group (Farmer, 2008a; Blackboard Inc, 2010). The strict control on the proportions of the composition of production cost enabled Blackboard to bring in growth driven by external innovations without being overwhelmed by the extra cost of maintaining them. Consequently, internal innovation was in trade off with external innovation for resource allocation.

Internal innovation was unfavourable in this trade-off due to the pursuit for growth driven by external innovation. In order to avoid the surged cost of post-acquisition, Blackboard managed to streamline management on its extended product portfolio. Blackboard set up deadlines for its acquired WebCT and Angel LMS to retire and upsell its more expensive Blackboard products to WebCT and Angel clients (Meyer, no date; Hill, 2012c), which was an attempt to cross-sell into the markets of the acquired product lines but control the cost of managing the acquired product lines. The decision to terminate WebCT and Angel LMS rendered them unreliable and insufficient in improvement, which brought about forced immigration of clients to rival LMS (Schaffhauser, 2010a; Hill, 2012c). Gilfus, the original innovator of Blackboard learning system who was the major promoter of internal innovation, left Blackboard after Blackboard merged with WebCT (Gilfus, 2000; Gilus, 2007).

TABLE 10: Blackboard, Inc.'s Increasing Propensity for External Innovation

| **Case No.1** | **Year** | **Blackboard Offering** | **External Acquisition** | **Market Growth** | **Revenue & Net Profit** (In thousands) | **R&D Cost** (In thousands) **VS Sales &Marketing Cost** (In thousands) | **R&D cost as a percentage of Total Revenue** (In thousands) |
|---|---|---|---|---|---|---|---|
| **Blackboard** | 2002 | Blackboard Learning System 6.0 (includes features from formerly acquired Prometheus and MadDuck Technologies) | Acquired Prometheus whose product features was integrated into Blackboard Learning 6.0 | 2600 Clients (global) | $69,946 & -$41,651 | $10,272 **VS** $24,176 42% | 14.7% |
| | 2003 | Blackboard Learning System 7.0 (includes features from formerly acquired Prometheus and MadDuck Technologies) | SA Cash was acquired to become Blackboard One™ | 3000 Clients (global) | $92,478 & -$1,425 | $11,379 **VS** $30,908 36.8% | 12.3% |
| | 2004 | **Blackboard Academic Suite:**<br>● Blackboard Learning System™ (includes features from formerly acquired Prometheus and MadDuck Technologies)<br>● Blackboard Community System™<br>● Blackboard Content System™<br>**Blackboard Commerce Suite:**<br>● Blackboard Transaction System™ (based on formerly acquired AT&T Campuswide and CEI Special Teams)<br>● Blackboard Community System™<br>● Blackboard One™ (based on formerly acquired SA Cash) | | 2229 Clients (USA) | $111,403 & $10,049 | $13,749 **VS** $35,176 39.1% | 12.3% |
| | 2005 | **Blackboard Academic Suite:**<br>● Blackboard Learning System™ (includes features from formerly acquired Prometheus and MadDuck Technologies)<br>● Blackboard Community System™<br>● Blackboard Content System™<br>**Blackboard Commerce Suite:**<br>● Blackboard Transaction System™ (based on formerly acquired AT&T Campuswide and CEI Special Teams)<br>● Blackboard Community System™<br>● Blackboard One™ (based on formerly acquired SA Cash) | | | $135,664 & $41,853 | $13,945 **VS** $37,873 36.8% | 10.3% |
| | 2006 | **Blackboard Academic Suite:**<br>● Blackboard Learning System™ (includes formerly acquired WebCT Campus Edition, WebCT Visa and features from formerly acquired Prometheus and MadDuck Technologies) | Acquired WebCT, Inc. whose products was renamed as Blackboard Learning System™ - CE Basic License (*formally WebCT Campus Edition-Focus* | >3400 Clients (USA) | $160,392 & -$10,737 | $27,162 **VS** $58,340 46.6% | 14.8% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | ● Blackboard Community System™<br>● Blackboard Content System™<br>● Blackboard Portfolio System™<br>● Blackboard Outcomes System™<br><br>**Blackboard Commerce Suite:**<br>● Blackboard Transaction System™<br>(based on formerly acquired AT&T Campuswide and CEI Special Teams)<br>● Blackboard Community System™<br>● Blackboard One™<br>(based on formerly acquired SA Cash) | *license*), - CE Enterprise License (*formerly WebCT Campus Edition),* and - Vista Enterprise License (*formerly WebCT Vista*). | | | | |
| | 2007 | **Blackboard Academic Suite:**<br>● Blackboard Learning System™<br>(includes formerly acquired WebCT Campus Edition, WebCT Visa and features from formerly acquired Prometheus and MadDuck Technologies)<br>● Blackboard Community System™<br>● Blackboard Content System™<br>(includes features from formerly acquired Xythos )<br>● Blackboard Portfolio System™<br>● Blackboard Outcomes System™<br><br>**Blackboard Commerce Suite:**<br>● Blackboard Transaction System™<br>(based on formerly acquired AT&T Campuswide and CEI Special Teams)<br>● Blackboard Community System™<br>● Blackboard One™<br>(based on formerly acquired SA Cash) | Acquired Xythos Software which was later added to Blackboard Content System™. | 3792 Clients (USA) | $213,631 & $10,479 | $28,278 **VS** $66,033<br>43% | $22,122<br>11.8% |
| | 2008 | Blackboard Academic Suite was renamed as **Blackboard Learn™**<br><br>Blackboard Commerce Suite was renamed as **Blackboard Transact™**<br><br>Acquired NTI Group product was renamed as **Blackboard Connect™** | Acquired NTI Group whose mass notification services was later renamed as Blackboard Connect™ | >5227 Clients (USA)<br>>6000 Clients (global) | $283,258 & -$1,936 | $40,580 **VS** $91,076<br>44.6% | 13% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2009<br>Moodle 经过四个学校证明成本较低 | **Blackboard Learn™**<br>(includes formerly acquired WebCT Campus Edition, WebCT Visa and ANGEL Learning Management Suite, and features from formerly acquired Prometheus and MadDuck Technologies)<br><br>**Blackboard Transact™**<br>(based on formerly acquired AT&T Campuswide and CEI Special Teams, and includes features from formerly acquired SA Cash)<br><br>**Blackboard Connect™**<br>(based on formerly acquired NTI Group product and includes the AlertNow service from formerly acquired Saf-T-Net) | Acquired ANGEL Learning and many features of its e-learning software were integrated into Blackboard Learning System™.<br><br>Acquired Terriblyclever Design, LLC to provide Blackboard Mobile™<br>(First Mobile Platform in market) | | $342,144 &<br>$7,912 | $45,967 **VS** $98,751<br>46.5% | 12.2% |
| | 2010 | **Blackboard Learn™**<br>(includes formerly acquired WebCT Campus Edition, WebCT Visa and ANGEL Learning Management Suite, and features from formerly acquired Prometheus and MadDuck Technologies)<br><br>**Blackboard Transact™**<br>(based on formerly acquired AT&T Campuswide and CEI Special Teams and includes features from formerly acquired SA Cash)<br><br>**Blackboard Connect™**<br>(based on formerly acquired NTI Group product and includes the AlertNow service from formerly acquired Saf-T-Net)<br><br>**Blackboard Mobile™**<br>(based on formerly acquired Terriblyclever)<br><br>**Blackboard Collaborate™**<br>(based on formerly acquired Elluminate and Wimba)<br><br>**Blackboard Anlytics™**<br>(Based on formerly acquired iStrategy) | Acquired Elluminate and Wimba, a combination that brings together industry-leading solutions for synchronous learning. Which was turned into Blackboard Collaboration™<br><br>Acquired Saf-T-Net, Inc. whose product was integrated into Blackboard Connect™<br><br>Acquired Presidium Inc. whose product was later turned into Blackboard Student Services.<br><br>Acquired iStrategy, a private company focused on data warehousing and business intelligence for higher education. It was turned into Blackboard Analytics. | | $412,641 &<br>$16,644 | $55,009 **VS** $121,190<br>45.4% | 12.3% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2011 | **Blackboard Learn™**<br>(includes formerly acquired WebCT Campus Edition, WebCT Visa and ANGEL Learning Management Suite, and features from formerly acquired Prometheus and MadDuck Technologies)<br><br>**Blackboard Transact™**<br>(based on formerly acquired AT&T Campuswide and CEI Special Teams and includes features from formerly acquired SA Cash)<br><br>**Blackboard Connect™**<br>(based on formerly acquired NTI Group product and includes the AlertNow service from formerly acquired Saf-T-Net)<br><br>**Blackboard Mobile™**<br>(based on formerly acquired Terriblyclever)<br><br>**Blackboard Collaborate™**<br>(based on formerly acquired Elluminate and Wimba)<br><br>**Blackboard Analytics™**<br>(Based on formerly acquired business assets of iStrategy)<br><br>**Blackboard Student Services™**<br>(based on foerly acquired Presidium) | Acquired Moodlerooms, Netspot and Txttools. | | | | |

***Data Sources**: Financial Reports of Blackboard, Inc. and Other Archival and Public Documents (Burn, 2006; Farmer, 2006; Blackboard Inc., 2007; Gilus, 2007; Nagel, 2009; Blackboard Inc, 2010; Kolowich, 2012b).*

Those acquisitions did help Blackboard to speed up its market growth and substantially added to its revenue before 2005, but the acquisition-driven growth was thereafter accompanied by the market share erosion of the learning management system of Blackboard Inc. – Blackboard Learn™. Blackboard's revenue surged from $135,664 in 2005 to $412,641 in 2010 (Blackboard Inc, 2005b; Blackboard Inc., 2010). In contrast with the revenue gain, the market share of Blackboard Learm™ in the American higher education sector fell from 71% when Blackboard acquired WebCT in 2006 to 50.6% in 2011whereas the competitors of Blackboard Learn™– Moodle, Canvas and Desire2Learn were all extending market shares (Campus Computing Project, 2011).

The contrast between the gain in revenue and loss in market share was initially attributed to the loss of the less profitable clients using low-end Blackboard Basic products but not those using high-end Blackboard Enterprise products (Farmer, 2008a). Moodle, as an open source LMS, gained mostly from the loss of Blackboard market share since 2006 to 2012 both in the American and North American higher education markets (Green, 2012; Phil Hill, 2017c). By pricing upon enrolled headcounts, Blackboard attached more importance to institutions of larger size, like SUNY system which covered 64 campuses (Farmer, 2008a). The less attended smaller institutions with lower affordability then switched to the cheaper alternative – open-source LMS, like Moodle (Straumsheim, 2014c).

Since 2009, another gainer from the loss of Blackboard was Canvas who made fast erosion into the LMS market from scratch to occupy 4% in the American higher education sector in three years' time (Green, 2012). In 2013, Canvas replaced Moodle

as the largest new LMS adopted in the North American market (LISTedTECH, 2017). The advantages of Canvas LMS over Blackboard LMS included its usability and reliability backed up by Amzon Cloud, Web 2.0 design and collaborative prototyping (Luthra, 2011; Uni, 2013; Pfeifer-Lukett, 2015a).

As Blackboard continued to acquire external innovations, it cut down further investment into the R&D of the acquired innovations, streamlined operation by integrating acquired LMS into Blackboard Learm™ and announced to terminate acquired LMS (Farmer, 2008b; Blackboard Inc, 2010). Blackboard Learm™ and its acquired LMS thus became "feature creep" and unreliable, which enabled Canvas to encroach into Blackboard's mainstream markets (Kelly, 2009; Hill, 2011a). The 'feature creep' of Blackboard was also evidenced in the interview with the e-learning director of a Russell Group university in the UK (see Appendices for interview transcript):

"I think *a lot of Blackboard clients would probably say the same thing…The problem with that is, they're not… the core functionality isn't being kept up to date. It isn't consistent enough, and there're still some silly problems that means it's not smooth enough for staff and students to use as it should be. I think, while it's nice to see new functionality being developed, I think you shouldn't do that if it means you're taking away resource that's required to keep the centre functioning as it should. And I think just now, there's too many bits of Blackboard, they don't work well enough together and the workflow is different…And I think that's why they suffer that we've got a huge*

*backlog of different features that have been added by developers over the last 15 or so years, and they're not all being kept up to date as they should be*".

The thing implied from the words of the e-learning director was that the constant add-up to the features and functions of Blackboard LMS had been at the expenses of the resources for making Blackboard more usable. The constantly added features had traded off the proper performance of those added features and the smooth workflow to use those features, which adversely affected customers' intent on turning those newly added features into real utility. The interview data is in line with the preconception that there is trade-off between different performance characteristics of product.

The secondary biggest beneficiary of Blackboard's loss from 2006 to 2012 was Desire2Learn which raised from 2% to 11.1% in terms of its market share in the American higher education sector (Green, 2010, 2012). The success of Desire2learn was initially because of its positioning against Blackboard as a less feature-ridden learning management system (Kats, 2010). In 2003, D2L was given credits for its convenience and functionality to replace Blackboard and WebCT which both operated on the campus of Wisconsin University in USA (Kempfert, 2003). Later, D2L continued to take business away from Blackboard for its better reliability and useful functionality to which Blackboard was inferior due to its poor maintenance of the acquired WebCT and Angle LMS (Bergfeld, 2007; Schaffhauser, 2010b; McLeod, 2011; Hill, 2012c).

Chronologically, the humble founding of Blackboard Inc drove its founders to search for external resources. The externally acquired product innovation and venture capital intermeshed well with its rapid market growth fuelled by cross-selling over an extended product portfolio and customer base. The outward orientation of growth strategy rendered Blackboard Inc insufficient in internal innovation, which aggravated the resource trade-off between internal innovation and external acquisition. The trade-off at organizational resource level gave rises to trade-offs explicit at product level. Consequently, those product level trade-offs made room for competitors to set in by leveraging product or business model innovations to break the trade-offs or to position at advantageous space of the trade-offs (Wessel and Christensen, 2012).

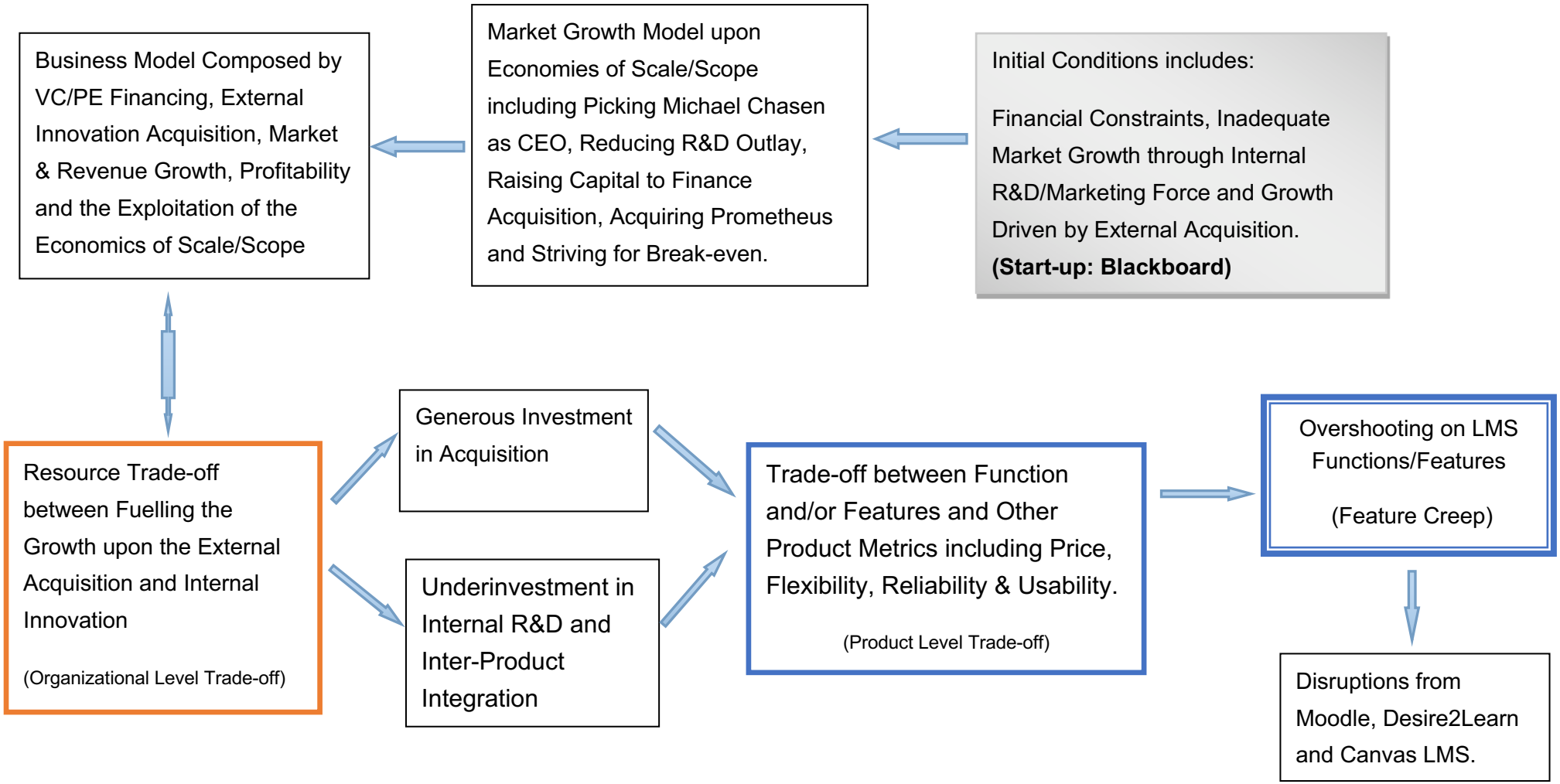
Moodle initially invaded the low-end higher education markets of Blackboard LMS (Raadt, 2012). During the same period, Desire2learn encroached into the mainstream LMS market of Blackboard by making its LMS less feature-ridden and simpler to use. In the early 2010s, the major force of erosion on Blackboard was handed over to Canvas LMS, which was given credits primarily for better usability. As Desire2learn could hardly be superior to Canvas for its usability (Trotter, 2008; Pfeifer-Lukett, 2015b; Iowa University, 2016; LMS Evaluation project team, 2016), it never surpassed Canvas in competing with Blackboard in terms of new clients acquisition until it enhanced product usability in 2016 (Ainoa, 2017; LISTedTECH, 2017; Phill Hill, 2017). Although none of the rival LMSs ever achieved complete disruption over Blackboard, the disruption of rival LMSs over incumbent Blackboard were evidently in process (Christensen, 2006b; Schaffhauser, 2010a; Chawdhry, Paullet and Benjamin, 2011;

Tynes, 2011; Dahl, 2011; Hill, 2011a, 2012c, 2012a; Luthra, 2011; K. Green, 2012; LISTedTECH, 2016).

The Blackboard case is summarized in Figure 4 which also depicts the emergent pattern regarding the shaping process of Blackboard's overshooting on the functions and features of its LMS. In comparison with the preconceptions in Figure 2, the emergent pattern from Figure 4 confirms that there was a trade-off between the different performance characteristics of product, which made for opportunities for disruptions from Moodle, Canvas and Desire2learn by reversing or breaking the trade-off between LMS functions and features, and other performance characteristics like price and usability. Therefore, the trade-off between different performance characteristics of product was evidenced and could thus be coded as the theme to support the definition of overshooting in this research.

However, there is an emergent theme yet covered by the preconceptions in Figure 2 that the trade-off between different performance characteristics at product level derives from the resource trade-off at organisational level. In Blackboard case, the resource trade-off between fuelling the growth upon external acquisition and internal innovation led to the trade-off between LMS functions/features and other performance characteristics including price and usability. The resource trade-off was consistent with previous research that there is commitment trade-off between external mergers and acquisitions, and endogenous growth of a company (Hitt, Hoskisson and Ireland, 1990). The emergent theme of resource trade-off was thus coded as commitment trade-off.

**Figure 4: The Shaping Process of Blackboard's Overshooting on Functions and Features**



By tracing the origins of Blackboard, Inc., the founding period of Blackboard as illustrated in Figure 4 was consistent with the the theoretical lens in Figure 2 that the initial humble conditions of Blackboard, Inc. served as the meta-routines shaping the dependent path of growing through external mergers and acquisitions. Later the VC/PE financing, external innovation acquisition, market & revenue growth, profitability and the exploitation of the economics of scale/scope of Blackboard, Inc. intermeshed each other as self-reinforcement mechanism to aggregate the commitment trade-off between external acquisitions and internal innovations.

However, the initial humble conditions of Blackboard and the intermeshed components of Blackboard's business model only implied the existence of meta-routine and self-reinforcement mechanisms in shaping the overshooting of Blackboard LMS. The humble conditions and the intermeshed elements of business model were only coded here as sub-categories of themes to be included into a broader category later in the cross-case analysis. The reason was because the humble condition and the interdependent components of business model may merely be the themes peculiar to Blackboard, Inc., so the themes holding up across different companies were needed as more robust constructs.

#### 4.2.2. Moodle Case

Moodle Pty Ltd was founded by Martin Dougiamas who developed the internet-based open-source learning management system called Moodle (Dougiamas, 1998, 2007). Martin was previously the IT staff of the Curtin University of Technology in Western Australia (Dougiamas, 2013). Throughout his work, he found it difficult to tailor

WebCT LMS to the needs of teachers because it was proprietary and closed-licensed and hence his initiative for a self-controlled courseware in 1998 (Dougiamas, 2007; Wan, 2017).

In 2001, Martin quitted his Curtin University job and continued to work on Moodle during the spare time of his PhD study regarding 'constructivism' which is an collaborative, interactive and shared pedagogy (Dougiamas, 1998). Being part of Martin's PhD research, the first version of Moodle learning platform was released as an open-source software contributable by a community of Moodle users and developers in 2001 (Dougiamas and Taylor, 2003b). In order to facilitate Martin's research and analysis into 'constructivism', Moodle was designed to be very flexible, compatible and modifiable by using popular PHP language, modular structure and Cascading Style Sheets (Dougiamas and Taylor, 2003b; Loffe, 2015).

In 2004, Martin had to orchestrate a financially sustainable business model for Moodle because his PhD scholarship come to an end (Dougiamas, 2007). The business model did not entail a license fee charged on LMS users as Blackboard. Instead, royalties were charged on Moodle Partners who were profitable companies certified by Moodle Pty Ltd to offer hosting, consulting, training and customizing services to end LMS users (Wan, 2017). Royalties from Moodle Partners were used to sustain Moodle Pty Ltd which hired software developers and other staff to maintain the open-source community of Moodle – Moodle.org (Gartner, 2015).

The business model of Moodle broke the trade-offs inherent in Blackboard LMS in many aspects, the most obvious aspect is that it broke the trade-off between certain costs of developing and marketing innovation. Moodle was free to be downloaded by users and developers worldwide. Reciprocally, Moodle users would contribute to Moodle community by reporting bugs, suggesting new features, testing quality, writing user documents and translating default languages; Moodle developers could contribute plugins, fix bugs, peer review patches, testing integration and maintaining developer documents (de Raadt, 2012). As a result, Moodle could add to product innovation without incurring as much cost as Blackboard LMS which had to pay for internal R&D and external acquisition of innovations. Moreover, Moodle was promoted largely based on word-of-mouth while Blackboard mainly market its LMS through sales team and other internal marketing force, which again rendered Blackboard more costly than Moodle (Farmer, 2006).

The lower cost made Moodle LMS meaningfully cheaper than Blackboard, which attracted the smaller and less affordable institutions (Randall, Sweetin and Steinbeiser, 2009; Tynes, 2011). According to the survey from Campus Computing Project (Kenneth Green, 2010), Moodle encroached most quickly into the higher educational LMS market for U.S. Private 4-year Colleges since 2005 and had accounted for 34.8% of the segment till 2010. In comparison with Research Universities or Public Colleges in America, the 4-year Private Colleges tend to be smaller in size and lower in affordability. This observation was increasingly evident as time went by. In 2014, Moodle occupied a larger market share than Blackboard in higher education institutions

with full-time equivalent students less than 2500 in North America (Edutechnica, 2014). The Product Development Manager of Moodle - Michael de Raad also confirmed about rise of Moodle that "*Being open source and free, Moodle is making inroads into smaller educational institutions, and this is something commercial LMSs have not been able to do*" (Raadt, 2012)

In the face of the encroachment of Moodle from the low-end market of Blackboard, Blackboard was initially reacting by being open. Instead of competing head-on, Blackboard Inc managed to integrate Moodle and other open-source LMS as one of its many plug-ins, which allowed educators to use certain functions of Moodle alongside Blackboard LMS (Guess, 2008). By doing so, Blackboard users could take advantages of two LMS while exclusive Moodle users only could use one.

Despite the response, Blackboard did not care as much about the small institutions as big ones due to the lack of financial incentive. After the acquisition of WebCT, Blackboard incurred evident loss of clients using the basic version of Blackboard while kept profitability intact (Farmer, 2008a). The reason was because Blackboard based pricing on the number of full-time enrolled students (Angelo, 2002), so smaller institutions tended to financially affect Blackboard Inc with smaller degree than larger ones. As a result, small-sized institutions were less attended by Blackboard and certain smaller community colleges in America reported the poor supports from Blackboard (Meyer, 2008; Randall, Sweetin and Steinbeiser, 2009).

As time went by, the adoption of Moodle by individual colleges accumulated enough to influence state-wide college system in the US (Randall, Sweetin and Steinbeiser, 2009), Blackboard sensed the threat and responded publicly that "*most open source products offer targeted, narrow functionality that allows for quick deployment and no license cost. Some of the many risks associated with dependency on these small-scale products are lack of support, lack of standard training, a small developer community, uncertain security policies, and no defined product roadmap to inform your decisions*" (Blackboard Inc, 2009).

Nevertheless, the criticisms from Blackboard were not proper for Moodle. Moodle was assessed to be similar to Blackboard in terms of functionality by certain institutions (Weaver, 2008; Randall, Sweetin and Steinbeiser, 2009; Behrens, 2010; Hayes, 2016). Moodle were already adopted by users across 100 countries in 2004 and the number of Moodle Partners had grown to around 40 serving about 1000 institutions in 2006 (Dougiamas, 2007). By the year of 2011, Moodle users were up to 44,966,541 in 214 countries (Powell and Lin, 2011) and Moodle Partners were already more than 50 (Moodle Pty Ltd, 2017). Moodle Partners provided support services including standard training (Dougiamas, 2007). Moodle Pty Ltd defined product development priority by using Moodle Tracker and formulated security policies (Gartner, 2015). The expanding Moodle user base also contributed to the development and maintenance of Moodle, like the €8 million invested by Open University in the UK to make Moodle more compatible, reliable and usable (Sclater, 2008).

Without most of the functionality and reliability issues brought up by Blackboard Inc, the cheaper and more customizable Moodle was increasingly accepted by larger and more influential institutions. In 2005, Open University in the UK selected Moodle as its official LMS for distance learning (Sclater, 2008). In 2006, the 'Open University in Canada' – Athabasca University adopted Moodle for its online courses (Dougiamas, 2007). Cambridge University in Britain, Monash University in Australia, California State University and Columbia University in America were examples of larger institutions adopting Moodle (Watkins, 2016). However, Moodle was still obviously more adopted by smaller institutions than larger ones in the light of the its overall market acceptance and it never surpassed Blackboard for serving medium-to-large higher education institutions in the American higher education sector (K. Green, 2012; Straumsheim, 2014c; *LMS Data – Spring 2017 Updates*, 2017).

While putting less weights on price, certain large universities emphasized that Moodle LMS was highly customizable for their needs as they adopted it. The committee responsible for the LMS selection for UCLA found the open source model of Moodle attractive for it could give priority to UCLA-specific needs (Farmer, 2007). The LMS selection committee of another public research university in America – Louisiana State University also appreciated the customization of Moodle by local staff (Course Management System Subcommittee, 2007). The Open University in the UK spent 5 million pounds to improve and customize Moodle (Sclater, 2008). Coastal Carolina University switched from Blackboard to Moodle mainly because its leadership favoured a more customized control on LMS operations, content and downtime

schedule (Hayes, 2016). The sort of customizability associated with Moodle LMS was confirmed by the following interview data with the e-learning director of a post-1992 university in the UK (see interview transcript from the pp.369-370 of this thesis):

"*It's (Moodle) outperforming Blackboard, I believe, because the people who are using it are the people who are designing it. So, generally speaking you have people out there who are coding it all the time who know what they want. They know what the community want. They have locked into the community… Organisations like Blackboard do their best to try and find out what people want, but they are kind of one step removed from it, because they are a company. And therefore, they're only able to do so much with the finite resources they've got. Moodle is much more responsive to change and as new patches and new plugins come out all the time, you can update and upgrade virtually every week.*".

The interview data suggests that Moodle is better than Blackboard in terms of customizability performances because Moodle is more responsive to institution-specific control, is designed by people who use it, and is supported by a community of Moodle users in timely manner. Those benefits brought about by customizability drive from the open source of Moodle LMS. Blackboard find itself hard to rival Moodle for customizability because it is a proprietary company.

Conversely, Blackboard seemed have more reliability problems than Moodle. After the acquisition of WebCT, Blackboard had to integrate acquired products into its existing products so as to ensure its cost do not expand as fast as its demand (Harper, 2006;

Farmer, 2008b). The integration with WebCT was later recalled by the Ex-President of Blackboard LMS as that "*We made some important mistakes in approaching the WebCT integration. We merged Blackboard and WebCT support too quickly and rushed to change support processes. The result was a disruption in support and service at just the time our clients needed us to be at our best…we encountered a large number of bugs (over 2,000) and some critical architectural issues. We kicked the fix effort into overdrive…Support, already adjusting to the changes we were making, was overwhelmed with tickets on issues we couldn't work through fast enough. Not surprisingly the experience for WebCT clients, and plenty of legacy Blackboard clients, suffered greatly''* (Henderson, 2009).

Correspondingly, the unreliable support for Blackboard-acquired WebCT forced clients to consider migration to alternative LMS (Instructional Technology Resource Center, 2006; Schaffhauser, 2010b; University of Massachusetts Amherst, 2010; Minnesota University, 2017). The forced migration was evidenced by the comments from the E-learning Director of a post-1992 university moving from WebCT to Moodle: "*It was end of product life actually. The WebCT product was ending, so we either had to…they were bought out by Blackboard, so at that time you either had to move from WebCT onto the full Blackboard product or you moved to an alternative product. So, that was really the driver for it… that initiated that review, that need to move products because the one we had was ending*" (see Appendices for interview transcript).

Later, as Blackboard acquired Angel LMS who occupied sizable market share, the forced migration also happened for previous Angel clients due to Blackboard Inc's

changeable announcements to terminate Angel LMS (Hill, 2012c; Straumsheim, 2014b). In 2009, Elon University reported about the unreliable support from Blackboard and decided to switch to Moodle(Tynes, 2011). In 2010, the University of Massachusetts Amherst, a public research university in the United States, migrated from the Blackboard-acquired WebCT to Moodle LMS for it could avoid unreliable vendor support by using locally hosted Moodle LMS (University of Massachusetts Amherst, 2010).

A secondary reason for the selection of Moodle over Blackboard was the 'feature creep' of Blackboard LMS (Eisen, 2009; Kelly, 2009). The feature creep was observed by the E-learning Officer from a Russel Group university by saying that "*I think, one of the criticisms of Blackboard is that there are too many ways to achieve the same task. You know, there's four or five possible workflows to make some changes and some of them have some very important but subtle differences that aren't clear to the person who uses it*" (see Appendices for interview transcript).

Before the acquisition of WebCT, Blackboard LMS was considered to be less sophisticated than WebCT (Web, 1998; Kats, 2010). Later, the integration of WebCT, Angel and other acquired LMS further sophisticated the function and feature of Blackboard LMS. As a consequence, Moodle was assessed to be easier to use than Blackboard LMS since its integration with WebCT (Instructional Technology Resource Center, 2006; Machado and Tao, 2007; Weaver, 2008; Marksbury, Zhang and Post, 2009). However, as Moodle was built differently from Blackboard, certain users accustomed to the Blackboard and its acquired LMS found it hard to adapt to Moodle,

which held them back to opt for Moodle (University of Massachusetts Amherst, 2010; Jobst, 2011).

In the face of the increasing threat from Moodle, Blackboard Inc changed its strategy of competing head-on (Hill, 2012a). In 2012, Blackboard acquired two of Moodle Partners – MoodleRooms in the US and NetSpot in Australia (Kolowich, 2012b, 2012a). The acquisition rose suspects about the motive of Blackboard for previously acquired LMS were all integrated into Blackboard LMS (Hill, 2014). However, Martin Dougiamas defended that Moodle cannot be purchased for its open-source nature and many other Moodle Partners were independent from Blackboard Inc (Lederman, 2012). Nevertheless, the acquisition was not in conflict with the logic of Blackboard's previous acquisitions and Blackboard Inc could still take advantages of Moodle's customer base to cross and up sell its wide product portfolio to realize growth.

From 2012 onwards, the market share of Moodle in the American higher education sector kept increasing and its secondary position to Blackboard maintained till the year of 2017 (Dimeo, 2017). However, its momentum of growth dwindled since the year of 2011 as another rival LMS – Canvas begum to gather momentum (Kim, 2011; K. Green, 2012; Phil Hill, 2017c) and finally overtaken Moodle in terms of market share in the US higher education sector in 2018 (McKenzie, 2018). Institutions reported moving to Canvas unanimously appreciated the less downtime, enhanced usability and user-interface of Canvas in comparison with Moodle (Morrill *et al.*, 2015; Learning Management Evaluation Committee, 2016; Minnesota University, 2017)

Chronologically, Moodle initially set foothold in the market of small institutions with lower affordability for no license fees charged by Moodle. As time went by, Moodle LMS became mature in comparison with Blackboard for functionality but more reliable and usable than Blackboard LMS. The reason was partially attributed to the innovative business model of Moodle and partially because Blackboard Inc was driven by external acquisitions to achieve growth. The product advantages of Moodle helped it replace Blackboard LMS in many big institutions. Blackboard reacted by acquiring two leading Moodle Partners and accepted open source as an inevitable business model in 2012. Since the year of 2011, Canvas begun to emerge as a more disruptive force than Moodle to erode the market share of Blackboard.

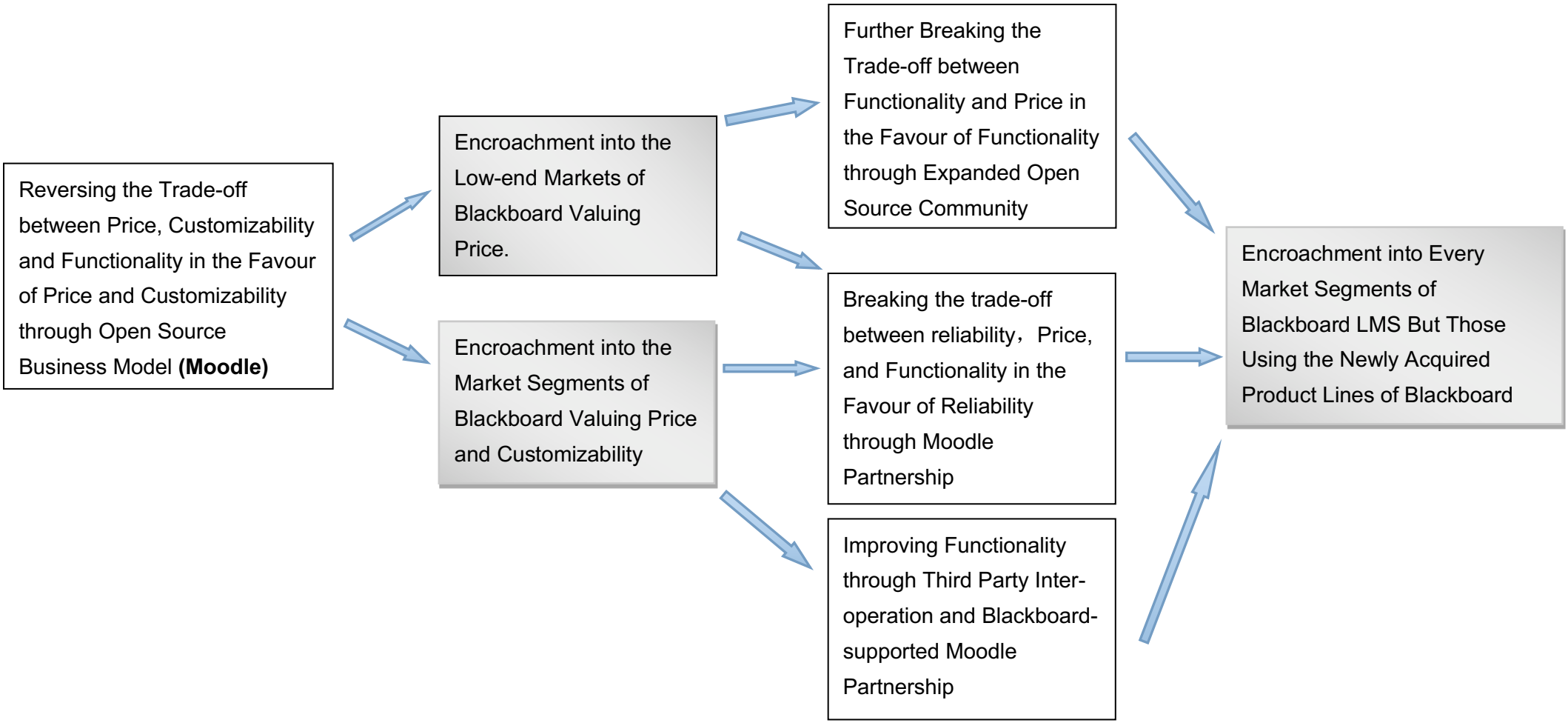
The following Figure (Figure 5) illustrates the key themes or categories extracted from Moodle's disruptive process consequent to Blackboard's overshooting. The case data supports the preconception in Figure 2 that trade-off-reversing innovation is initially consequent to incumbent's overshooting by occupying the markets peripheral to the mainstream market of incumbent. The case data also conforms to the preconception in Figure 2 that trade-off-breaking innovation can be consequent to incumbent's overshooting. According to Figure 5, Moodle initially built up disruptive innovations reversing the trade-off held by Blackboard but later break the trade-off by using the competences it initially leveraged for reversing the trade-off, like Moodle Community.

The shaded boxes in Figure 5 inform about the themes or categories consistent with the preconceptions including compromised performance and nonabsorbable performance as overshooting. The customers who initially switched from Blackboard to Moodle

were those not so much in the need of the abundant functions and features of Blackboard LMS but very much in the need of low price and LMS customizability. Those initial customers were overshot because their desired performance characteristics of LMS were compromised by Blackboard. Therefore, the shaded boxes in the left half of Figure 4 contains the themes and coded data supporting compromised performance as overshooting.

In the shaded box of the right half of Figure 5, Moodle disrupted into the mainstream market of Blackboard. The reason for the mainstream customers to switch to Moodle was because Moodle LMS could make them better absorb the functions and features of LMS. The low price and customizability could enable LMS users to buy more functions and features and adapt the functions and features to their specific needs. In comparison, Blackboard's negligence in low price and customizability restricted its mainstream customers to better absorb its overprovided functions and features even they actually needed the abundance. Therefore, the case data coded as Moodle's disruption into the mainstream market of Blackboard is consistent with the preconception - nonabsorbable performance as overshooting.

**Figure 5: Moodle's Disruptive Process Consequent to Blackboard's Overshooting**



The case data also support the theoretical relationships among compromised performance as overshooting, nonabsorbable performance as overshooting, trade-off-reversing disruption and trade-off-breaking disruption as specified in Figure 2. The consistency between the theoretical relationships as coding paradigm in Figure 2 and case data evidences the mechanisms through which the decomposed dimensions of overshooting causes disruptions in the low-end (institutions with low affordability)/new (institutions in the need of customizability) markets and mainstream (medium to large institutions) markets of incumbent (Blackboard).

#### 4.2.3. Canvas Case

Canvas LMS was innovated because of its innovators' dreadful experiences with Blackboard LMS. Canvas was initially developed by two Brigham Yong University students – Brian Whitmer and Devlin Daley who were studying towards their Master degree in Human-Computer Interaction in 2008 (Kolowich, 2012c). Brian ever took classes regarding product usability with Devlin and both of them were upset with the usage of Blackboard LMS in the role of student and teaching assistant (Whitmer, 2010). They thought LMS as the means to the end desired by teacher and student but not the end itself (Israelsen-Hartley, 2010). Therefore, they made up their minds to offer a new LMS making teaching and learning easier than that done by Blackboard and other LMS at that time (Whitmer, 2018).

The decision drove Brian Whitmer and Devlin Daley to utilize the latest technological means to achieve the aim of making teaching and learning easier. Web 2.0 technologies including Ruby on Rails, JQuery, HTML5 and CSS3 were adopted to make the

interface of Canvas smooth and modern (Instructure Inc, 2018). Google Docs, Facebook, Twitter and other popular tools were incorporated into Canvas so that users can access information through their most familiar web tools (Israelsen-Hartley, 2010; Tripathi, 2015). They also managed to reduce grading workflow to only a few clicks so as to remove the burden of teachers (Feldstein, 2010a).

Brian and Devlin's building up an easier LMS happened as Blackboard was in the middle of constant acquisitions. Up to the year of 2008, Blackboard had acquired WebCT for three years, was in the course of acquiring NTI Group and was about to acquire Angel in 2009 (Blackboard Inc., 2010). The constant acquisition but poor integration with the acquired products rendered Blackboard LMS clunky and unreliable (Eisen, 2009; Henderson, 2009; Schaffhauser, 2010a; Empson, 2012b), which caused the losing of market shares since the acquisition of WebCT in 2005 (K. Green, 2012). Canvas was developed by Brian and Devlin with 'anti-Blackboard' as target (Whitmer, 2018).

Poor usability was only the symptoms, Brian Whitmer believed that the root of the problems was the reluctance of Blackboard to put more weights on end users but on campus-wide administration and management aspects of LMS (Whitmer, 2018). Blackboard used to sell LMS and engage customers through the IT administrators and managers of universities but not directly through teachers and students (Riddell, 2013). Although IT administrators and managers would maintain LMS on daily basis and adapt LMS to the specific needs of teachers and students, teachers and students but not IT administrators were the end users of LMS.

The interview data answerable to interview question for campus IT or E-learning officers also evidence that they tended to be more concerned with campus-wide administration issues than those related to daily end-user experiences. In the answers from the interviewed E-learning officer to the question - 'what is important for a Virtual Learning Environment (LMS) in your view?', a Russel Group E-learning officer said that "*I think, one of the most important questions is, how do you get information in and out of it. So, whenever we look at new software, one of the questions we always ask is: Thant's great, if we buy it now and in five years' time want to change to a different vendor, how can we extract our data from your system and import it into something else?*" (see Appendices for interview transcript).

In another answer to the same question from the E-learning officer of a post-1992 university in the UK, the similar concern was also expressed about the openness and interoperability of LMS. "*For me, the most important thing for a VLE (LMS) is that we stop the things like the homogenisation of content. Stop things like the walled garden approach. We start to think about being more open and democratic in the way they are run. And that means that often we have to give students the option to change things. Which at the moment is impossible to do with lots of VLEs. So, the most import thing for me is that we open up learning*" (see Appendices for interview transcript).

Brian Whitmer and Devlin Daley approached to their venture start-up class instructor – Josh Coates who was a serial entrepreneur in online storage industry. Josh financed Brian and Devlin as angel investor to start up Instructure, Inc. (Knighton and Reichman, 2014) Inside Instructure, labs program and research team were set up in separation from

the engineering and product team to glean end-user insights (Tripathi, 2015). Sometimes, the more importance attached to teachers and students as end users caused institutional administrators/managers to complain about the neglects on them, Instructure still insisted on taking the end-user needs as priority (Whitmer, 2018).

The end-user mentality also drove Brian and Devlin to engage end-users throughout product development. As recalled by Brian that "*Instead of starting to write code, which both of us loved doing, we took all our ideas and built them into a mocked-up version of the product in PowerPoint. Then we started calling schools. We would cold-call the CTO, CIO or the head of Instructional Design and tell them we were a new company who wanted to show our thoughts on the future of the LMS and get their feedback as well. We had a very favourable response, and met with eighteen universities over the summer of 2008 including UCLA, Berkeley, UNLV, UVU, Westminster and USC. Everyone loved what we were doing and gave us great feedback. After each school we'd write down a ton of notes, re-work the PowerPoint and go at it again. We learned a TON and ended up with a very compelling product*" (Whitmer, 2010).

This approach differs from a normal customer engagement approach, such as focus group or customer survey, that it used 'collaborative prototyping' to engage customers. The most significant aspect of collaborative prototyping is that the "*actual prototype was used as a tool for communication or development, thus serving as a platform for the cross-fertilization of knowledge. In this way, collaborative prototyping leads to a better balance between functionality and usability; it translates usability problems into design changes, and it detects emerging usability problems through active engagement*

*and experimentation"*(Bogers & Horst, 2014 p.744). The mocked-up version of product made by Brian and Devlin was the actual prototype and the outcome was that the functionality and usability of Canvas LMS was better balanced than Blackboard (UITS Learning Technologies Functional Requirements Committee, 2013).

Armed with better functionality and usability, Canvas LMS also leveraged cloud technology to elevate reliability to a new standard. The Amazon Web Service was used as the infrastructure to host Canvas so that users would experience much less downtime than on-premise hosted LMS as Blackboard (Arrington, 2011; Instructure Inc, 2016). The cloud-hosted Canvas was so reliable that the largest education program in the world - Cisco Networking Academy selected Canvas to accommodate the needs of its more than one million students across 165 countries around the world (Empson, 2012c).

As wished by Brian Whitmer and Devlin Daley, the better functional, usable and reliable invaded directly into the mainstream market served by Blackboard. In 2010, the Utah Education Network switched from Blackboard Vista system to Canvas. As Utah Education Network covered 109,000 Utah college students and 29,000 higher education faculty and staff at that time, it was the sort of sizable institution targeted by Blackboard (Allen, 2010). In 2011, another long-term sizable client of Blackboard – Brown University left Blackboard to Canvas by highlighting the hassle-saving navigation of Canvas interface and the convenient Canvas notifications via Facebook, Twitter, email or text message (Luthra, 2011). Up to the year of 2012, Canvas had been adopted by 189 institutions with about 2.7 million users (Empson, 2012c).

In 2013, Indiana University in the USA conducted an all-around comparison between Blackboard, Canvas and other major LMS which showed that Blackboard LMS was with the problem of 'feature redundancy' (Committee and University, 2013). The comparison revealed that Canvas was of higher utility than Blackboard in spite of its higher feature-richness than Canvas. The contradiction between feature completeness and usefulness was partially attributed to feature redundancy. For example, Blackboard had three different tools to disseminate message inside one course site. In contrast, Canvas was more adaptable and agile in response to the exact needs of users.

The adaptability and agility of Canvas to meet the various demand of users derived partially from its could hosting technology. As Canvas centrally hosted on the Cloud, the features of software could thus be provided on demand by customers. In contrast, Blackboard was a monolithic, full-featured software could only be hosted on-premise (Hill, 2012b). Instead of selling a monolithic software, Canvas adopted the Software-as-Service model to charge annual subscription fee from customers who could ask for extra features to add to the Canvas used locally. As a result, Blackboard was less flexible and costlier than Canvas in response to the heterogeneous demand of customers.

Apart from the Software-as-Service upon cloud technology, other important measures were also adopted by Instructure to increase the customizability of Canvas. In 2011, Instructure released a version of Canvas LMS based on AGPL open source license and further improved Canvas' interoperability with third-party software (Instructure Inc, 2011). In 2013, Canvas was made like iPhone to build up an App Centre for LMS users to install third party apps at their own discretion (Knighton, 2013). although Blackboard

launched such a platform for third party blocks to be built into its LMS long before, Blackboard only allow institution-wide installation or uninstallation of apps while Canvas removed the restriction by letting apps to be installed on individual basis (Empson, 2013b). The app center was positively received by the faculty of Missouri University as they migrated from Blackboard to Canvas (Technology Evaluation Subcommittee, 2016).

As Instructure constantly innovated to make its LMS more customizable according to the heterogeneous demand of customers, Blackboard was still actively making acquisitions. In 2009, Blackboard acquired Angel and announced to terminate the LMS in five years' time (Straumsheim, 2014b). In 2010, Wimba and Elluminate was acquired to become Blackboard Collaborate; iStrategy was acquired to become Blackboard Analytics. Presidium was acquired in 2011 to become Blackboard Student Service. In 2012, Moodleroom and NetSpot were acquired to be transformed into Blackboard's Open Source Services division (Blackboard Inc, 2010; Kolowich, 2012b, 2012a).

The acquisitions largely added to the growth of Blackboard Inc (Farmer, 2008a). However, the gains from acquisitions were in severe trade-offs with loss incurred for Blackboard LMS. The most evident loss was the feature-ridden Blackboard LMS induced by integrating different acquired LMS (Henderson, 2009; Kelly, 2009). Management commitment was directed more to the growth opportunity brought by acquisition but not the post-acquisition integration. The feature-ridden product was the driving force of many migrations from Blackboard to Canvas(Morrill *et al.*, 2015; Pfeifer-Lukett, 2015a; Iowa University, 2016; UNO Canvas Task Force, 2017).

Although the demand on functionality was largely satisfied by the combination of different LMS, the weakened usability derived from poor integration largely offset increased functionality.

The secondary loss was from the acquired products complementary to LMS. After the acquisition of those complementary products, insufficient commitment was made to ensure the consistency across different products. Instead, different product were kept quite independent from each other so that students had to change between products even for a single assignment (Lapowsky, 2015a). The independence of products from other may facilitated cross-selling and up-selling into institutions using rival LMS. However, independent structure complicated the usage of Blackboard LMS. The functionality of complementary products was thus in trade-off with the usability of Blackboard LMS and its complements.

However, the trade-off between the demand on functionality and usability was broken by Instructure even it grew as fast as Blackboard. The primary reason was that Instructure rarely acquired for growth opportunities. Instructure only acquired once since its founding in 2008 to the time it became publicly listed in 2015 (Instructure Inc, 2016). Instead, Instructure relied on internal force to develop new product. In 2015, Instructure launched Arc as its collaboration product whereas Blackboard acquired Wimba and Elluminate as its collaboration tool (Blackboard Inc., 2010; Instructure Inc, 2016). As commented by the CEO of Instructure - Josh Coates: " we have a bias against M&A other than very limited cases" (Schaffler, 2015).

Moreover, Instructure attached more importance to customers than to rapid growth. Instructure did not mind reiterating its product development process to absorb customer insights (Whitmer, 2014). Canvas was designed based on market analysis and feedback which were provided by a team exclusive for it inside Instructure (Hill, 2011b; Tripathi, 2015). Instructure adopted 'collaborative prototyping' to achieve the balance between functionality and usability (Whitmer, 2010). The product, customer, and sales division worked cross-functionally to engage with different stakeholders to interpret customer needs (Instructure Inc, 2016). As customers were closely listened, their demand on product functionality and usability were both satisfied.

Additionally, Canvas took advantage of the cloud technology to alleviate the demand trade-off between functionality and reliability. The utilization of Cloud technology made software scaling and upgrading no longer costly as much as on-premise Blackboard but more reliable (Hill, 2012b). As a result, Canvas did not confront the resource trade-off between product functionality and reliability as Blackboard, which enabled resources to be concentrated on product development itself. The consequence was that the cloud-based Canvas LMS could better satisfy the demands on functionality and reliability while Blackboard had to face more severe trade-off between the two demands.

As Canvas was superior to Blackboard in terms of reliability and usability while not inferior for functionality, the newly launched Canvas was soon selected by many institutions to replace Blackboard LMS (Hill, 2011a; A. James Clark School of Engineering, 2012; Uni, 2013; Penn State Information Technology Services and

Outreach and Online Education, 2015; Ramos, 2016a; DeShong, Vanderlan and Brannan, 2018). In 2011, the University of Texas at Austin conducted assessment across different LMS. The selection committee appreciated Canvas' well-functioned grading system, reliable 24-hour support and usable modern user interface. (Burke, 2013). In 2015, Pennsylvania State University moved to Canvas from Blackboard-acquired Angel after finding Canvas was functionally useful and usable (Penn State Information Technology Services and Outreach and Online Education, 2015). In 2018, Cornell University, the oldest adopter of Blackboard LMS, decided to migrate to Canvas as faculty found Canvas less clunky than Blackboard (DeShong, Vanderlan and Brannan, 2018). By the time of 2018, Canvas was almost taking the leadership in terms of market share in the American higher education sector (McKenzie, 2018).

Chronologically, Canvas LMS was initially developed to challenge Blackboard's unfavorable end-user experiences in 2008. As time went by, the features of Canvas was enriched according to the needs of teachers and students but not growth opportunities as Blackboard, which enhanced the utility of Canvas features to a level higher than that of Blackboard (UITS Learning Technologies Functional Requirements Committee, 2013). Moreover, Canvas was operated upon SaaS model in 2008, opened its source code in 2011 and equipped with App Centre in 2013. All those measures improved the customizability of Canvas for users both at institutional and individual level. Canvas have achieved rapid growth throughout 2013 to 2017 (Instructure Inc, 2016, 2018).

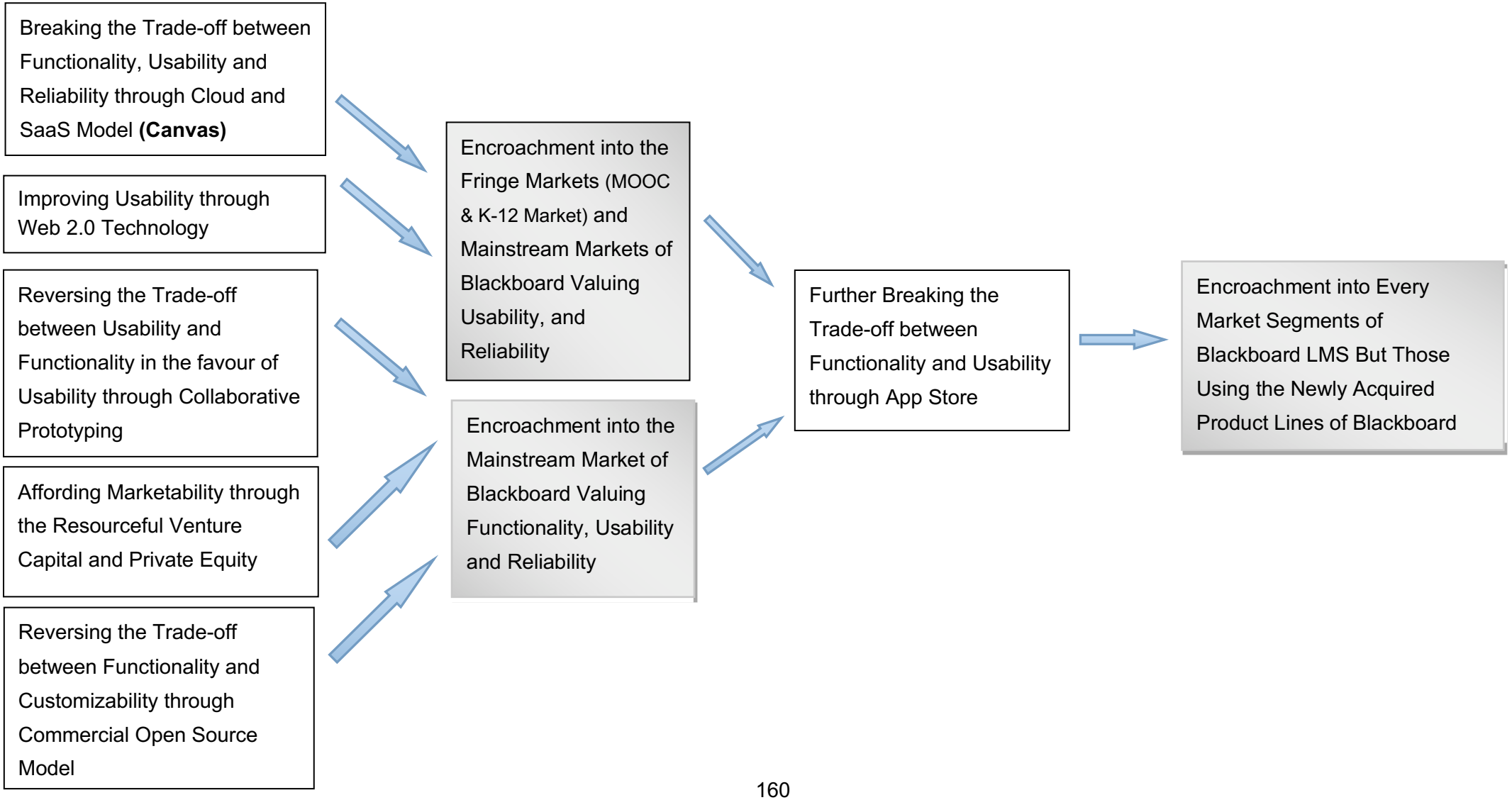
The case data of Canvas is categorised by Figure 6 as below. By comparing with Figure 2, There were trade-off-breaking and trade-off-reversing disruptions made by Canvas.

However, the case data was not consistent with preconceptions that the initial disruptive innovations of Canvas did not only include those reversing the trade-off of Blackboard LMS but also include the ones breaking the trade-off, which helped Canvas to disrupt directly into the mainstream market of Blackboard.

The innovations breaking the trade-off held by incumbent product emphasizes mainstream-market disruption consequent to overshooting (Van Orden, van der Rhee and Schmidt, 2011; Christensen *et al.*, 2018). Mainstream market disruption indicates the disruptive innovations directly encroaches into the mainstream market of incumbent (Denning, 2015). Unlike low-end and new-market disruptions, the data of Canvas case shows that mainstream disruption does not initially occupy markets peripheral to the mainstream market of Blackboard through trade-off-breaking disruption but encroach into the mainstream market through trade-off-breaking disruption. According to case data, the mainstream disruption of Canvas broke the trade-off of Blackboard LMS through disintermediating the IT administrators of institutions to serve the needs of teachers and students as end users.

The shaded boxes in Figure 6 refers to and categorises the case data reflecting the overshot customers' switch to disruptive innovations. Canvas broke the trade-off hold by Blackboard LMS and the mainstream customers of Blackboard felt that Canvas LMS would better meet their needs for its improved usability and reliability which would help them to absorb the abundant functions and features of LMS. Comparatively, Blackboard LMS was inferior to Canvas LMS at that time in terms of reliability and usability, which rendered Blackboard LMS more hardly absorbable for its abundant -

**Figure 6: Canvas' Disruptive Process Consequent to Blackboard's Overshooting**



-features and functions. Therefore, institutions left Blackboard to Canvas were actually falling victims to nonabsorbable performance as overshooting. Consequently, as predicted by preconception in Figure 2, the overshot mainstream customers of incumbent Blackboard switched to Canvas as trade-off-breaking disruption.

The shaded boxes in Figure 6 also supports that the compromised performance as overshooting in Figure 2. The MOOC and K12 markets were the markets very much in the need of LMS usability and reliability because of the huge scale of MOOC users and the less tech-savvy children. When the founders of Canvas used certain product and business model innovations to improve the usability and reliability of LMS, like collaborative prototyping, the trade-off between LMS features/functions and usability/reliability were reversed. Therefore, the case data of Canvas also confirms

#### 4.2.4. Desire2Learn Case

Desire2Learn LMS was launched into market three years after the first version of WebCT LMS, its number of features was less developed than that of WebCT and hence less user fatigue caused by the lower usability and reliability of multi-featured WebCT (Thompson, Hamilton and Rust, 2005). At that time, WebCT was regarded overly sophisticated, Desire2Learn successfully replaced WebCT to be adopted by some institutions which regarded Desire2Learn as less sophisticated but more usable and much cheaper than WebCT (*WebCT - Wikipedia*, no date; Meyer, 2008; Kats, 2010). Wisconsin University, Maryville University and Rose State College were previous WebCT or WebCT/Blackboard adopters but who later switched to D2L for its ease-of-use and reliability (Kempfert, 2003; Moreau, 2006; Bergfeld, 2007)。

Apart from the meaningful product positioning against WebCT, Desire2Learn also expanded well upon innovating new technologies to accommodate educational trends. In 2003, the University of Wisconsin selected Desire2Learn to replace WebCT/Blackboard which were

both running on campus at that time (Kempfert, 2003). The win over WebCT/Blackboard was partially given credits for its newly launched product – Learning Repository Object(LRO) which is a reservoir for sharing, saving and tracking learning objects (Kempfert, 2003; Chioreanu, 2005b). The Director of ITS's Academic Technology unit of Colorado University at Boulder ever commented as they selected Desire2Learn: "…*We chose Desire2Learn in part because curricular designs increasingly call for incorporating reflective ePortfolios and outcomes assessment that follow students throughout their career and beyond and improve student learning....*" (McLeod, 2011). In 2011, Surrey University in the UK switched from Blackboard to Desire2Learn and "*a major driver for the selection was Surrey's desire to provide a more personalized learning environment to students, to allow them to collaborate more easily, and to enable them to work on both computers and mobile devices*" (Schaffhauser, 2011).

D2L also benefited more as WebCT was acquired by Blackboard. Throughout 2006 to 2012, Blackboard acquired several major rival LMS vendors including WebCT, Angel and other two companies based on Moodle's open source. The acquisitions drove Blackboard to consolidate the features of different LMS into an one-size-fit-all product (Hill, 2012a). However, the integration of the features from different LMS required R&D commitment but which was neglected by Blackboard management (Henderson, 2009; Whitmer, 2018). The consequences are the poor reliability of the WebCT performance after acquisition (Schaffhauser, 2010a; Wheeler and Mcleod, 2011), which manifested itself as unresponsive supporting service team (Meyer, 2008). Moreover, the prospect of WebCT was doomed by Blackboard's decision to terminate WebCT in 2011 (Butler University, 2011). On contrast, Desire2Learn only ran one LMS and was more responsive than Blackboard to the requests of Clients. The resultant higher reliability of D2L attracted certain institutes to migrated from Blackboard-acquired WebCT to D2L (Schaffhauser, 2010a, 2011).

The more reliable and usable product positioning against the Blackboard-acquired WebCT sustained the growth of D2L. However, D2L was refrained by Moodle in its encroachment into Blackboard's LMS market due to the better customizability of Moodle. The better customizability derived from the fact that Desire2learn was like Blackboard as a proprietary software while Moodle was open source. "*Desire2Learn, I think, have the same problems as Blackboard in as much as they are both proprietary companies, they are both big companies who are trying to make a profit, trying to keep their shareholders happy*. *The thing is, they can only respond so often to changes, and so therefore, their update packs only come out every six months or so. And therefore, you have to keep waiting when there's a problem*", said by the E-learning Director of a post-1992 university in the UK (see Appendices for interview transcript).

From 2006 to 2012, D2L's market share expanded from 2% to 11.1% in the higher education sector of American LMS market whereas Blackboard shrank from 71% to 44.8% (K. C. Green, 2010; K. C. C. P. Green, 2012). The most benefited from the loss of Blackboard was not Desire2Learn but Moodle whose market share rose from 4.2% to 20.1% (K. Green, 2012). As Moodle clients are normally self-hosted or hosted by outside vendors, like Moodleroom, Moodle is no less than Desire2Learn in terms of supporting service. Moreover, Moodle, as open source software, was more customizable than Desire2Learn as a proprietary software, which was also a competitive advantage over Blackboard who was trying to make an one-size-fit-all LMS (Hill, 2014).

The E-learning officer from a Russel Group university also confirmed the migration from Blackboard to Desire2Learn and Moodle due to the unreliability of Blackboard 9.0 during the years between 2009 and 2011 by saying that "*I think they lost a lot of customers moving to 9.0 and it broke things and it was at a time when people were wondering, "Well, should we stay with Blackboard?" You know, it was unfortunate for them that a lot of their customers were*

*probably four or five years old and were now due the next institutional review and deciding whether or not to stay with Blackboard. And Desire2Learn and Moodle are saying, "Well, come and user our stuff instead"* (see Appendices for interview transcript).

From 2012 onwards, Desire2Learn was increasingly rivalled by another emerging competitor instead of Moodle. From 2013 to 2016, Desire2Learn kept losing some its long-term clients chosen to Canvas (Pfeifer-Lukett, 2015a; LISTedTECH, 2016; LMS Evaluation project team, 2016). Wisconsin University who had been with D2L since 2003 switched to Canvas based on the its better usability perceived by faculty and better reliability based on cloud technology (Wong, 2013; Pfeifer-Lukett, 2015b, 2015a). Ohio State University, previously selected Desire2Learn in 2005, went for Canvas in 2016 because of the useful function, ease-to-use and clean user-interface of Canvas LMS (Chioreanu, 2005a; Office of Distance Education and elearning, 2015; Ramos, 2016b). Oklahoma University left Desire2Learn to Canvas after they found the improvement of D2L LMS were marginal over the bygone two years, comparing with the substantial usability enhancement of Canvas LMS (Oklahoma University, 2016a). Iowa University, another long-term client of Desire2Learn, migrated to Canvas in 2016, again for its feature usability and effectiveness (Chioreanu, 2005b; Iowa University, 2016). The loss of old clients was a commentary on the disadvantage of D2L on making product more usable and useful than Canvas.

However, Desire2Learn was actually quite aggressive to arm itself for a more rapid market growth during this time. In the late 2011, John Baker, as the CEO of Desire2Learn, hired Dennis Kavelman who used to be the CFO and then COO of RIM which was the parental company of Blackberry smartphone (Kavelman, 2012). Afterwards, D2L was financed by New Enterprise Associates (NEA) and OMERS Ventures up to $80 million (Lardinois, 2012). NEA was experienced with Cloud technology and transformed D2L's offerings to be more SaaS-based (Sakoda and Viswanathan, 2012). The round of financing also initiated a series of

acquisitions to enable ‘Adaptive Learning’ and ‘Competence-based Education’ which both emphasize the smartness of technology in enabling more personalized education (Christensen, Johnson and Horn, 2010). The acquired technologies include Degree Compass – an automatic course recommendation engine, Wiggio – a group collaboration tool, and LeaP-an adaptive learning engine (Empson, 2013a; Lunden and Empson, 2013; Virginia, 2013).

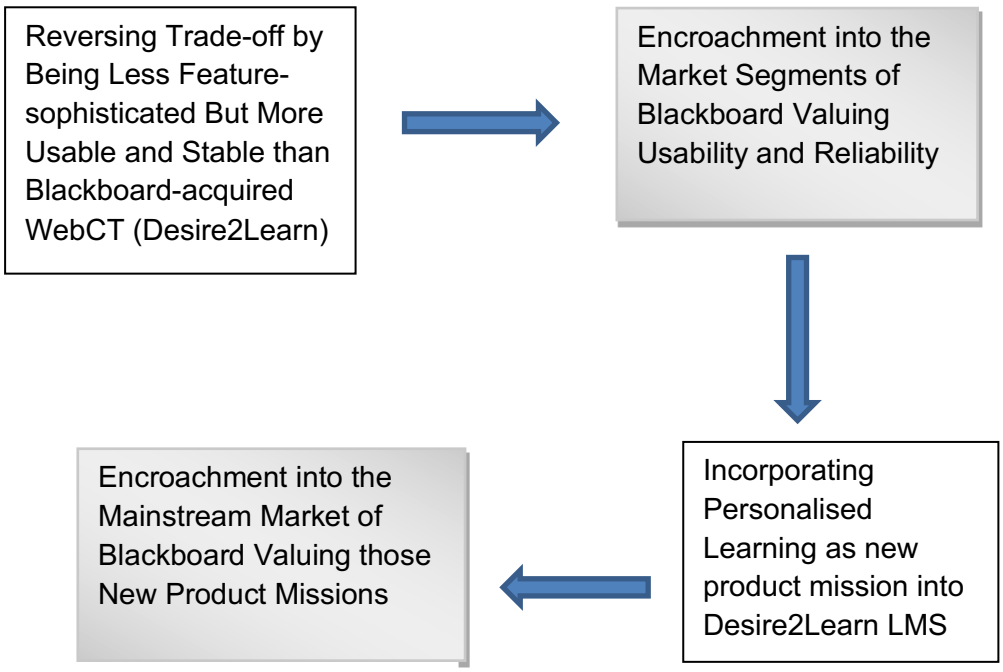
In spite of those newly acquired features, Desire2Lean was still held back by the insufficient usability of the new features to kick off a more rapid growth. In 2014, the University of Oklahoma was struggling with the integration of its data with D2L product and the difficulty in data analytics was also found by other clients (Michael, 2013; Oklahoma University, 2016b). The inferior usability of its core LMS was propelling its long-term clients to leave for Canvas. In 2016, University of Colorado Boulder switched to Canvas for its “ease of use and intuitiveness, mobile friendliness, and open-core architecture allowing flexibility” (LMS Evaluation project team, 2016; Pfeifer-Lukett, 2016). Also, the more usable Canvas replaced D2L’s encroachment into the market of Blackboard (University of Missouri, 2015).

In 2016, the arrival of the new Chief Operating Officer - Cheryl Ainoa helped D2L in disputing LMS clients with Canvas by improving the utility and usability of D2L LMS (Ainoa, 2017). Cheryl Ainoa was previously working for Yahoo in its global marketing sector, so the long-time working in the global marketing sector slide her into the habit of being very customer-engaging and always consider product development as a process of constant trial-and-go between R&D staff and customers (Michael, 2013; Phill Hill, 2016; Ainoa, 2017). Instead of pushing newly developed or acquired functions and features towards clients as done in the bygone years, D2L turned to tune in the voices of customers at every stage of product development and prioritized feature development to make product more usable and useful from clients’ perspective (Phil Hill, 2017b). The improved usability and utility of D2L’s LMS and features enabling personalized learning did receive immediate positive feedback. According to

the data of LISTtech, D2L was equivalently competitive as Canvas in acquiring new North-American higher education clients in the first half of 2017 (Phill Hill, 2017).

The case of Desire2Learn is coded and categorised in Figure 7 which also illustrates the disruptive process of Desire2learn consequent to Blackboard's overshooting. The first half of the Desire2learn case data is consistent with the preconceptions in Figure 2 that Desire2learn used trade-off-reversing disruption to initially encroach into the market segments valuing usability and reliability of LMS. Those market segments were different from the mainstream market segments targeted by Blackboard by valuing less of the LMS functions and features.

**Figure 7: Desire2Learn's Disruptive Process Consequent to Blackboard's Overshooting**




The encroachment pattern of Desire2Learn's trade-off-reversing disruption is also supportive of the preconception that the compromised performance as overshooting. The shaded box in Figure 7 tells that the market segments valuing LMS usability and reliability were the foothold set initially by Desire2Learn. The initial customers who switched from Blackboard to Desire2Learn were actually overshot by Blackboard's compromised performances in terms of

LMS usability and reliability, which is consistent with the compromised performance as overshooting.

However, the case data of Desire2learn seems to describe a new theme of disruption that the disruptive Desire2Learn did not later break the trade-off that it previously reversed. Instead, Desire2Learn incorporated new performance characteristics of product appealing to the mainstream markets of the incumbent Blackboard. The observation is consistent with prior research that a disruptor may combine a new dimension of product performance to disrupt a company (Charitou and Markides, 2003; Raffaelli, 2018). However, disruptor still need to break the trade-off between the new dimension of product performance and incumbent's core dimension of product performance to disrupt into the mainstream market of incumbent, which is still consistent with the preconception of trade-off-breaking disruption.

Where the case of Desire2Learn is concerned, the personalised learning capability of Desire2Learn LMS was not in severe trade-off with its number of LMS functions and features, which enabled Desire2Learn to disrupt into the mainstream market of Blackboard. Conversely, the personalised learning capability gave more convenience and simplicity for LMS users to absorb the features and functions of Desire2Learn LMS through artificial intelligence. By contrast, the features and functions of Blackboard LMS were comparatively inconvenient to be absorbed for its lack of artificial intelligence at that time. Therefore, the case data of Desire2Learn still support the preconceptions that Desire2Learn breaks the trade-off between personalised learning and LMS feature number to disrupt directly into the mainstream market of Blackboard LMS which was overshooting customers for its nonabsorbable performance.

Up to this point, emergent themes like commitment trade-off, humble conditions as meta-routine mechanism and business model components as self-reinforcement mechanism are yet to be determined as the generalizable themes regarding the antecedents of overshooting. In the

next section, cross-case analysis will be conducted to generate more generalizable themes as the antecedents of overshooting. However, it is worth to note that some of the themes or categories emerged from the different single cases of this section point at certain themes or categories in common, which means those categories or themes have been confirmed through 'repetitive logic'. In this section, the themes or categories triply validified by preconception, single case data and cross-case data are compromised and nonabsorbable performance as overshooting, trade-off-breaking and trade-off-reversing disruptions and their relationships. However, those categories or patterns share in common that they are from the demand level of analyses about what is overshooting and how and why does overshooting brings about disruption? The next section will see those issues from the supply level of analysis.

### 4.3. Cross-case Analysis

In order to ensure the generalizability of the emerged pattern and avoid the pitfall of building theories upon an overly idiosyncratic case, multiple case comparison are resorted in the following section to construct the theories regarding the antecedents and consequences of overshooting and cases are confirmed and disconfirmed with each other to better enhance the validity and generalizability of the theory developed (Eisenhardt and Graebner, 2007).

In the following content, three antecedents of overshooting will be ascertained through the theoretical lens of three basic mechanisms fostering the persistent pattern of organizational behaviours (Schreyogg and Sydow, 2011). The persistent pattern of product improvement based on the three mechanisms will be located and studied within each of the cases of Blackboard, Moodle, Desire2learn and Canvas. Afterwards, comparison will be made across cases to generate the themes regarding the three antecedents of overshooting. The same process

will be applied to generate themes about the mechanism of overshooting and consequent disruption from the analytical level of supply.

Like within-case analysis, the emergent themes from cross-case analysis will be compared with the corresponding themes from within-case study to arrive at more balanced and validified construct. As a result, Blackboard's disruptions by Moodle, Canvas and Desire2Learn will serve as the units of analyses to be compared with each other to replicate and extend the preconceptions in Figure 2 and emergent themes from within-case studies.

#### 4.3.1. Overshooting Associated with Meta-routine Mechanism

Table 11 displays the case data supporting the constructs and theoretical relationships generated from the cross-case analysis of the overshooting associated with meta-routine mechanism. The evidences are displayed with their supported constructs which are tabulated in a way to illustrate their causal relationships. As mentioned in the methodology chapter, Table 11 does not show a diverse sources of evidence to support each construct as done by other cross-case analysts (Eisenhardt, 1989; Gilbert, 2005). However, those constructs are supported by evidences across the different cases or units of analysis based on repetitive logic (Yin, 2017). Also, the reduced diversity of data sources makes it possible to present constructs and their theoretical relationships in the same table with their supported case data, which balances between theory and story (Eisenhardt, 1991).

According to the theoretical lens of this research, the fixed or persistent pattern of organizational behaviour does not come out of thin air. Instead, a more restricted pattern of behaviours was initially shaped by the mechanism of 'meta-routine' which is "*the propensity of selecting particular solutions for certain types of problems*" (Driel and Dolfsma, 2009 p.51). Before the emergence of meta-routine, organizational behaviours tend to be random and

unpredictable. The turning point from the random into a restricted scope of behaviours or meta-routine should be identifiable.

By comparing the initial founding process across different LMS companies, 'Mission Perception' was identified as the turning point for different LMS companies to have certain propensities for LMS innovation. "*A product mission is a description of the job which the product is intended to perform*" (Ansoff, 1957 p.147). When the founders of a company perceive the missions to be fulfilled by a product, the product concept is almost generated. Concept generation is defined as "*identifying the market opportunities for new products and services*" (Tidd and Bessant, 2014, p.409). The missions needed by consumers to be fulfilled are the rightful market opportunities for new product development (Christensen and Raynor, 2003). As concept generation is normally the first step of new product development process (Carson, Wu and Moore, 2012), it often exerts profound impacts on the subsequent steps of product development including concept screening, product and process development, and business model build-up (Trott, 2008).

According to the case data from Table 11, the product mission perceived by the co-founders of Blackboard – Matthew Pittinsky and Michael Chasen were to make learning management online. Online learning management was previously absent from the market of higher education institutions. As Matthew Pittinsky was doing his master degree at Harvard University, he found that Harvard faculty members begun to use web technologies but none started to use web in class for teaching and learning and hence the concept of Learning Management System to manage teaching and learning online (Burn, 2006). At that time, schools were yet to use internet for teaching and learning, the concept thus focused on bringing information technologies into a blue ocean market – the market for teaching and learning management (Karpowicz, 2017).

**Table 11:** ***Antecedents and Consequences of the Overshooting Associated with Meta-Routine Mechanism***

| LMS | Mission Perception | Mission Prioritization Overshooting | Mission Reprioritization Disruption |
|---|---|---|---|
| **Blackboard** | **Incumbent Product Mission (Online Learning Management)**: "One day I just got this idea for Blackboard, I remember I was jogging along the Charles River and it dawned on me that at different places around the Harvard University campus the faculty was starting to use the Web. I wondered if they were using the Web in their class work." said Matthew Pittinsky – Co-founder and Former Board Chairman of Blackboard, Inc (Burn, 2006).<br><br>**Incumbent Product Mission (Online Learning Management): "**It's funny, because when I started at Blackboard, our very first venture capital investor called up 5 schools to do their due diligence on us to see if they would utilize technology to put courses online. The feedback they got from that outreach was that those schools would never use technology to put courses online. The feedback was that teachers were luddites, and students were not interested. The thing is, we knew that 100% of schools were eventually going to put course material on the Internet", said by Michael Chasen – Co-founder and Former CEO of Blackboard, Inc (Karpowicz, 2017). | **Mission Prioritization Overshooting: Product Innovation Prioritized Blackboard's Product Mission (Online Learning Management) over Other Product Missions (like Beautiful, Original or Preferred LMS):** "One of Michael's key influences on the early company was its agility. Not everything Blackboard created was beautiful, original, nor perfected. But it was often the first out, the most widely known, and packaged with enough of the services and company attributes needed to win against larger but slower companies", blogged by Ray Henderson – Former President of Blackboard Learn (Henderson, 2012).<br><br>**Mission Prioritization Overshooting: Business Model Prioritized Blackboard's Product Mission (Online Learning Management) over Moodle's Product Mission (Customizable LMS):** "Blackboard offers full customer service and support, something you will not get with an open source product. And as far as product development goes, I have 100 developers working for me now. We have yet to lose in a bake-off to open source and I don't expect that we will", said by Michael Chasen – Co-founder and Former CEO of Blackboard, Inc (Burn, 2006).<br><br>**Mission Prioritization Overshooting: Development Process Prioritized Blackboard's Product Mission (Online Learning Management) over Canvas' Product Mission (End-user-friendly LMS):** "UX Director of Operations Andy Jacobson, who helps facilitate the team's work by helping them reach out to users, tells us that just a few years ago, the people the company talked to would have been 90% system administrators, Blackboard's main points of contact on campuses. Working through those administrators, the company made an effort to gather direct feedback from students and teachers…", reported by Roger Riddell about the product development process of Blackboard (Riddell, 2013). | **Disruption over Incumbent (Blackboard ) in the Markets with Reprioritized Demand on the Product Mission of Disruptor (Moodle) or the Performance Characteristics Supporting the Product Mission**: Since 2006, Moodle's market share begun to grow evidently faster than before because the WebCT termination made certain institutions feel necessary to build up their LMS so as to avoid forced termination in the future (Justin, 2015c). Up to the year of 2014, Moodle occupied a larger market share than Blackboard in higher education institutions with full-time students less than 2500 in North America (Edutechnica, 2014) and Moodle tended to be more favored by smaller institutions than all other major competitors (Justin, 2015b).<br><br>**Disruption over Incumbent (Blackboard) in the Markets with Reprioritized Demand on the Product Mission of Disruptor (Canvas) or the Performance Characteristics Supporting the Product Mission:** In America and Canada, Instructure attracted a great majority of LMS switching from Blackboard and its acquired LMS companies to Canvas LMS from 2011 to 2017, which was sharply contrasted with all other LMS only winning minor shares from Blackboard (Justin, 2015a; Phil Hill, 2016b, 2017a; Feldstein, 2017b; Minnesota University, 2017; Edutechnica, 2018b). |

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| **Moodle** | **Incumbent Product's Compromised or Overlooked Mission: (Customizable LMS)**: "However as WebCT evolved, I found it more and more difficult to get it to integrate with other systems we had and because it was proprietary, closed-licence software, I was not able to make the functionality changes that teachers wanted or allowed to fix urgent bugs myself—I had to wait for support. I found this very frustrating and decided to try to write a better system for helping teachers use the innate power of the Internet", recalled by Martin Dougiamas – Founder and CEO of Moodle Pty Ltd (Dougiamas, 2007). | **Mission Reprioritization Innovation: Product Innovation Reprioritized the Product Mission of Moodle (Customizable LMS)**: "Moodle has been designed to be compatible, flexible and easy to modify…Originally this approach was adopted so that Martin could rapidly create or modify interfaces in response to our analysis and research interests…", co-written with Martin Dougiamas – Founder and CEO of Moodle Pty Ltd (Dougiamas and Taylor, 2003b).<br><br>**Mission Reprioritization Innovation: Business Model Reprioritized the Product Mission of Moodle (Customizable LMS):** "I (Martin) have been researching the methodologies employed by a large number of open source projects – formal and informal – by observing and participating in their development communities…Over several years I have noticed certain features of the projects that seem to attract and maintain such learning communities, and applied this experience in setting up the environment for the Moodle community", co-written with Martin Dougiamas – Founder and CEO of Moodle Pty Ltd (Dougiamas and Taylor, 2003b). | **Institutions Switched from Blackboard to Moodle Mainly for the New Product Mission of Moodle (Customizable LMS) or the Performance Characteristics Supporting the Product Mission:** Certain institutions with high demand on LMS customizability selected Moodle. Louisiana State University, Coastal Carolina University and Massachusetts Amherst University in USA migrated from Blackboard to Moodle largely because Moodle is more customizable than Blackboard, which helps to address issues including response to institution-specific requirements, compatibility with other internal software systems, and control on LMS downtime, content and operation (Course Management System Subcommittee, 2007; University of Massachusetts Amherst, 2010; Hayes, 2016). |
| **Canvas** | **Incumbent Product's Compromised or Overlooked Mission (End-user-friendly LMS)**: "BYU used Blackboard as their LMS, and we were so frustrated with the product both as students and as TA's, that we decided to poke around that market a little more"，blogged by Brian Whitmer – Co-founder and Former CPO of Instructure, Inc (Whitmer, 2010).<br><br>"Blackboard really did a great job at capturing the market, but maybe took their eye off the ball on innovation. They focused more on capturing revenue, and growth happened not from trying to make | **Mission Reprioritization Innovation: Product Innovation Reprioritized the Product Mission of Canvas (End-user-friendly LMS)**: "A lot of feedback we've gotten is that people switch to Canvas because we're easier to use", said by Josh Coates – Co-founder and CEO of Instructure, Inc (Wan, 2014b).<br><br>"When clients say they're leaving us for Instructure, we scratch our heads. We have more functionality", said Phil Miller - Chief Learning and Innovation Officer at Blackboard (Tate, 2018).<br><br>"They're (Instrucutre, Inc.) not focusing particularly on open education or analytics or any other hot topics in online education, although they are aware of these and do pay some attention to them. Rather, they are looking at core use cases and trying to make them as simple as possible, throwing out some outdated LMS design assumptions in the process" (Feldstein, 2010a). | **Institutions Switched from D2L to Canvas Mainly for the New Product Mission of Canvas (End-user-friendly LMS)**: Wisconsin University who had been with D2L since 2003 switched to Canvas based on the its better usability perceived by faculty and better reliability based on cloud technology (Wong, 2013; Pfeifer-Lukett, 2015b, 2015a). Ohio State University, used Desire2Learn since 2005, went for Canvas in 2016 for the useful function, ease-to-use and clean user-interface of Canvas LMS (Chioreanu, 2005a; Office of Distance Education and elearning, 2015; Ramos, 2016b). Iowa University, another long-term client of Desire2Learn, migrated to Canvas in 2016, for its feature usability and effectiveness (Chioreanu, 2005b; Iowa University, 2016). |

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| | customers happy, but from more acquisitions", said by Josh Coates – Co-founder and CEO of Instructure, Inc (Wan, 2014b). | **Mission Reprioritization Innovation: Development Process Reprioritized Product Mission of Canvas (End-user-friendly LMS):** "Instead of starting to write code, which both of us loved doing, we took all our ideas and built them into a mocked-up version of the product in PowerPoint. Then we started calling schools. We would cold-call the CTO, CIO or the head of Instructional Design and tell them we were a new company who wanted to show our thoughts on the future of the LMS and get their feedback as well", Blogged by Brian Whitmer – Co-founder and Former CPO of Instructure, Inc (Whitmer, 2010). | **Institutions Switched from Blackboard to Canvas for the New Product Mission of Canvas (End-user-friendly LMS)**: University of Missouri moved from Blackboard to Canvas largely because of its better usability (Technology Evaluation Subcommittee, 2016) University of Wisconsin – Madison and University of Nebraska Omaha migrated from Blackboard to Canvas for its better usability and simplicity perceived by teachers and students (Morrill *et al.*, 2015; UNO Canvas Task Force, 2017) |
| **Desire2Learn** | **Incumbent Product Mission (Online Learning Management)**: "At the University of Waterloo at that time, they were also transitioning from cassette tapes, and from mailing in forms for assignments, so I thought maybe, by leveraging the power of the internet, we could really do a big transformation on the educational experience here at the university…And then, after a few interactions with clients, I saw the huge opportunity that it was and decided to make it a full-time venture", said by John Baker – Founder and CEO of Desire2Learn (Reinhart, 2012b). | **Mission Prioritization Overshooting: Product Development Prioritized Desire2Learn's Product Mission (Online Learning Management) over Canvas' Product Mission (End-user-friendly LMS):** "In the past D2L has seemed too interested in being able to do some chest-thumping "We've got CBE. We've got Predictive Analytics. We've got Adaptive Learning." while missing something on what current and even prospective customers need in their daily lives" , blogged by Phil Hill – long-term LMS industry analyst (Phill Hill, 2017).<br><br>"The general point is that I see signs that D2L as a company tends to have an enterprise-y approach to product design, and that may have hurt them in this and other cases...In fact, Blackboard made essentially the same prioritization decision with its own retention analytics feature set. In general, the enterprise-y approach is very good at delivering features but not nearly as good at solving customer problems" blogged by Michael Feldstein– long-term LMS industry analyst (Michael, 2013). | **Disruption from Disruptor (Canvas) over Incumbent (Desire2Learn) in the Markets with Reprioritized Demand on the Product Mission of Disruptor (Canvas):** From 2013 to 2016, Desire2Learn kept losing its long-term mainstream clients to Canvas, but never to Blackboard or other rival LMS (Chioreanu, 2005a; Pfeifer-Lukett, 2015a; Iowa University, 2016; LISTedTECH, 2016; LMS Evaluation project team, 2016). |

In the case of Moodle, another LMS was created for different mission perception upon different market information. The founder of Moodle was previously an IT administrator at Curtin University of Technology in Western Australia, so he knew thoroughly about the need of LMS functions by universities. Nevertheless, he found it difficult to customize a proprietary and closed-licensed LMS for the specific needs of faculties and hence his initiative for a more customizable LMS based on open-source software (Dougiamas, 2007; Wan, 2017).

The resultant product mission was perceived as "*I was not able to make the functionality changes that teachers wanted or allowed to fix urgent bugs myself-I had to wait for support*" (Dougiamas, 2007). In that perception, the initial product mission perceived by Blackboard was reprioritized to be as equally important as the new product mission – customizable LMS. In other words, the reprioritized product missions preserved online learning management as important product mission while made customizability a new product innovation priority.

The difference between the Blackboard's product mission and the Moodle's product mission led to different routines by the two companies. Blackboard built up its business model based on selling new LMS functions and features (H. Gibbs Katz, 2010) and constantly incorporated new functions and features from acquired products so as to get as many jobs of learning management online as possible (Harper, 2006). In contrast, Moodle's market opportunity was to improve the customizability of LMS functions, so Moodle LMS prioritized customizability by making product design compatible, flexible and easy to modify by using popular programming languages and simple software infrastructure (Dougiamas and Taylor, 2003b, 2003a).

As displayed in Table 11, the sort of routines induced by mission perception is here discovered to be associated with the "meta-routine" mechanism to enable overshooting. Routine is the "*repeated patterns of response involving interdependent activities that become reinforced*

*through structural embeddedness and repeated use*" (Gilbert, 2005 p.742). Product mission routine is here defined as repeated patterns of organizational practices consistent with the missions generated for new product development. Similar to other routines, the repeated pattern may involve interdependent activities like business model, product design and development process embedded with organizations. Product development is normally a sequential process going from concept generation at front-end phrase throughout many other organizational activities at the back-end phrase including product, process and business model development which are easily routinized according to their initial concept generation (McCarthy *et al.*, 2006). As a result, the product mission generated as the market opportunity to start up a company could be the initial concept generation to exert impacts and become the dominant logic to cause routines or repeated pattern of organizational behaviours (Bettis and Prahalad, 1995).

Where Blackboard is concerned, product innovation, business model and development process inside Blackboard worked as product mission routines constantly prioritized its product mission – online learning management over other missions needed by customers, which left out opportunities for disruption. As Blackboard identified market opportunity as online learning management, Blackboard's profit model was largely depended on features of online learning management or LMS features delivered to customers (Burn, 2006; Blackboard Inc., 2007). Backboard accelerated LMS feature delivery through constant acquisitions and incorporation of rival LMS (Gilus, 2007; Flook, 2010) and boosted price at according to the number of features (Angelo, 2002).

Unlike Blackboard, Moodle charged no license fee on feature delivery, which was an indispensable part of Moodle's open source model to enable customizability for individual users and the contribution of users' customized work back into Moodle community for further LMS feature improvement (Gartner, 2015). On one side, the product mission routine inside Blackboard, Inc. made for the trade-off between feature number and price, causing difficulties

for those less affordable smaller institutions. On another side, Moodle broke the trade-off through its own product mission routines prioritizing customizability. Those price-sensitive customers – smaller institutions then migrated to Moodle which later occupied a larger market share than Blackboard in North American institutions with enrolled students less than 2500 in 2014 (Straumsheim, 2014c; Gartner, 2015). Up to this point, Moodle had disrupted into the markets of Blackboard valuing the performance characteristics supporting the product mission of Moodle – cheapness.

Certain researchers may argue that the diminishing marginal utility from additional function made smaller or larger institutions less willing to pay and hence the disruption from the cheaper Moodle LMS (Adner and Levinthal, 2001; Adner, 2002). In that circumstances, bigger institutions should had not left Blackboard for Moodle for they were not as diminishing as smaller institutions in terms of the marginal utility from additional function, which were against evidences (Farmer, 2007; University of Massachusetts Amherst, 2010; Hayes, 2016). Moreover, the diminishing marginal utility should had levelled off license fee to reflect customer needs but which was actually on the rise as Blackboard incorporated more competitors' functions into its own LMS (Meyer, 2008; Angelo, 2002; Harper, 2006), which evidenced about Blackboard's prioritization of LMS features delivery over other market opportunities including a lower price. Additionally, the free license fee was another evidence that Moodle alleviated the product mission routine prioritizing online learning management over customizability for a license-fee-based software would hold users back to customize by making LMS proprietary.

As highlighted by Table 11, the disruption was enabled through and preceded by the mechanism refereed here as 'mission prioritization overshooting'. Mission prioritization overshooting happens if an incumbent company's routines prioritizing a mission generated for product development to the extent of overlooking or compromising alternative missions to be

fulfilled by certain customers. As other companies may offer alternative products to alleviate incumbent's product mission routines by reprioritizing the overlooked or compromised product missions, the compromised product missions are then improved to a level acceptable to certain customers who favour then. The consequence of mission prioritization overshooting is the disruption from the company with reprioritized product mission to improve the overlooked or compromised missions by incumbent product.

In comparison with the themes emerged from within-case analysis, the market outcome of mission prioritization overshooting is compromised performance as overshooting. The within-case analysis suggests the category or theme of commitment trade-off between internal innovation and external acquisition. By comparing with the theme or category – mission prioritization overshooting from cross-case analysis, it is revealing that the commitment trade-off derives from incumbent's prioritized resource allocation for its targeted market needs or missions required by customers. The emergent theme from cross-case analysis is also in consistent with prior theory that there is a path dependence of resource allocation based on the more desired customers by company (Christensen and Bower, 1995). Therefore, the category of commitment trade-off is considered as the phenomena of the more underlying mechanism - mission prioritization overshooting.

As the customizability was not prioritized in the initial missions perceived by Blackboard founders, Blackboard's business model tended to prioritize online learning management features while overlooked or compromised other market opportunities including customizability. Although Blackboard business model was advantageous at functionality delivery by having professional developers and marketing forces in house (Burn, 2006; Farmer, 2006), its proprietary and in-house business model compromised or traded off the customizability of LMS by not allowing customers to change LMS on their own strengthen. This pattern of prioritizing online learning management over customizability was embedded

with the proprietary business model of Blackboard, which, in return, constantly improves the number of LMS features over its customizability.

By contrast, Moodle constantly improved the customizability of LMS overlooked and compromised by Blackboard. The founder of Moodle investigated into the different approaches of open source projects to make sure the active help between developers and users in Moodle community (Dougiamas and Taylor, 2003b). Along with the expansion of Moodle community and Moodle headquarter, Moodle LMS was supported by more and more developers and users around the world (Powell and Lin, 2011; Moodle Pty Led, 2017). As a result, Moodle LMS was further improved for customizability through its open source model.

The disruption from Moodle became evident when certain customers of Blackboard recognized the importance of the customizability advocated by Moodle. In 2006, Blackboard acquired its biggest rival LMS – WebCT and announced the termination of WebCT in 2011 (Butler University, 2011). The termination forced many institutions to migrate off Blackboard and alerted them to the importance of building up their own LMS to avoid future termination, which put Moodle in much higher demand than before (Justin, 2015c). The termination of WebCT caused a shift of customer demand towards the customizability of building up one's own LMS. However, if customers originally had such a demand on customizability, the disruption would still not had happened without Moodle's improvement on the customizability overlooked and compromised by Blackboard.

Certain institutions switched to Moodle did have a prioritized demand on customizability. In 2007, Louisiana State University, a sizable public research university in USA, switched from Blackboard to Moodle because of its customizability by local staff and the similar functionality between Moodle and Blackboard (Course Management System Subcommittee, 2007; Farmer, 2007). In the same year, UCLA in America selected Moodle for its customizability could give

priority to UCLA-specific needs (Farmer, 2007). Coastal Carolina University in USA migrated from Blackboard to Moodle mainly because of its leadership favouring a more customized control on LMS operations, content and downtime schedule (Hayes, 2016). Also, Open University in the UK spending a big sum on customizing Moodle but selecting a ready-for-use proprietary LMS was another reflection on the sort of institutions with prioritized demand on customizability (Sclater, 2008).

Correspondingly, the market outcome of mission reprioritization overshooting is trade-off-reversing disruption. From market perspective, certain customers overshot by Blackboard LMS found the Moodle LMS reversed the trade-off between the performance characteristics desired by them and that desired by the mainstream customers of Blackboard. From the organisational perspective, the disruptive Moodle actually reprioritized the product missions perceived by its founders to make the trade-off-reversing disruption. Therefore, mission reprioritization overshooting as the theme emerged from cross-case analysis complements and confirms the trade-off-reversing disruption as the theme from preconception.

However, Moodle's product mission routine of building up one's own LMS overlooked and compromised other market opportunities including end-user friendliness, which made for the difficulties holding end-users back to adopt Moodle. Up to the year of 2014, the disruption from Moodle over Blackboard was far from completion for Moodle LMS was still more adopted by smaller institutions than larger institutions (Straumsheim, 2014c). This observation was because certain institutions did not like the complexity and cost of building up or maintaining their own LMS and hence their use of a ready-for-use LMS (Sclater, 2008; Minnesota University, 2017). The complexity and cost of customizing Moodle LMS was confirmed by the interview data from another e-learning director of a Russell Group university in the UK (see interview transcript in the p.400 of this thesis):

*"The hosting company for us, could also do that. We… So, we could ask them to develop something very bespoke for us and adopt it and develop it. Which is an option with Moodle, we could do what we want. The downside of that is the more custom functionality you make, the more risk it breaks when the main Moodle system upgrades. If it isn't written in an appropriate way, that development could become unusable".*

The surged disruption from Moodle over Blackboard since 2006 lost its momentum when Canvas emerged as important alternative since 2011 (Kim, 2011; Justin, 2015c; Phil Hill, 2017c). Canvas LMS did not overshoot users by trading too much end-user friendliness off for customizability but put end-user friendliness as its prioritized concept and market opportunity (Whitmer, 2010; Wan, 2014b). Like Moodle, Canvas also made its LMS open source for users to customize but mainly relied on its proprietary staff to offer a ready-for-use and cloud-hosted LMS, which largely reduced the complexity of customizing and maintaining LMS (Feldstein, 2011; Instructure Inc, 2011). Just as one instructor from Minnesota University commented "*With Moodle, it's like having a garage filled with car parts. Canvas is actually like having a car in the garage. With Moodle, you can actually assemble whatever car you want if you know how to put together a car. With Canvas, I have something I can pull out of the car (sic) and drive with … but it's the chosen car*" (Minnesota University, 2017, p.16). The comment is consistent with the evidence that Canvas later surpassed Moodle in disrupting Blackboard more completely (Kim, 2011; K. Green, 2012; Phil Hill, 2017c; McKenzie, 2018), which is another evidence supporting mission prioritization overshooting.

According to Table 11, another observation regarding Desire2Learn and Canvas may serve as the theoretical repetition of the propositions induced from the case between Blackboard and Moodle. Like the co-founder of Blackboard, the founder of Desire2Learn – John Baker also identified the market opportunity for using web technologies to better off education as a student on campus two years after the inception of Blackboard (H. Gibbs Katz, 2010; Reinhart, 2012a).

Also like the co-founder of Blackboard, John believed in solving educational problems through technology for his combined background between education and technology (Rogers, 2014), which drove him to develop new functions and features incorporated into Desire2Learn LMS to improve education.

John Baker once recalled his identification of the initial missions for Desire2Learn that "*At the University of Waterloo at that time, they were also transitioning from cassette tapes, and from mailing in forms for assignments, so I thought maybe, by leveraging the power of the internet, we could really do a big transformation on the educational experience here at the university…And then, after a few interactions with clients, I saw the huge opportunity that it was and decided to make it a full-time venture*" (Reinhart, 2012a). Therefore, the product mission of D2L LMS is online learning management.

The similar product mission with Blackboard led to similar product mission routines with Blackboard. The product innovation inside Desire2Learn was inclined to prioritize feature development. Before 2012, Desire2Learn LMS was well received by certain institutions for its new functions and features including Learning Repository Object, ePortfolios and Personalized Learning (Kempfert, 2003; McLeod, 2011; Schaffhauser, 2011). After 2012，Desire2learn actively acquired new technologies including the automatic course recommendation engine – Degree Compass, the group collaboration tool – Wiggio and the adaptive learning engine – LeaP (Wan, 2014c).

In spite of the obvious feature improvements and new features, Desire2Learn overlooked and compromised the end-user friendliness of its product. The overlook was observed by Phil Hill who is a long-term consultant and industry analyst covering the educational technology market primarily for higher education and ever commented that "*In the past D2L has seemed too interested in being able to do some chest-thumping "We've got CBE. We've got Predictive*

*Analytics. We've got Adaptive Learning." while missing something on what current and even prospective customers need in their daily lives*" (Phill Hill, 2017). The compromise embedded into the product development process of Desire2Learn and was commented by another long-term analyst for higher education technology – Michael Feldstein that "*I see signs that D2L as a company tends to have an enterprise-y approach to product design, and that may have hurt them in this and other cases...In fact, Blackboard made essentially the same prioritization decision with its own retention analytics feature set. In general, the enterprise-y approach is very good at delivering features but not nearly as good at solving customer problems*".

By contrast, another LMS Company – Instructure reprioritized the product missions of LMS to incorporate and prioritize a new mission – end-user friendliness into its Canvas LMS. The co-founders of Instructure, Brian Whitmer and Devlin Daley found teachers and students around them were frustrated with the usage of Blackboard LMS (Israelsen-Hartley, 2010; Whitmer, 2010). They tried other LMS including Moodle to see if there was a better alternative for Blackboard but none lived up to their expectations (Kolowich, 2012c). Afterwards, they decided to make a LMS targeted at teachers and students as the end-users of LMS but not IT administrators or other campus-wide management (Whitmer, 2018).

Both Brian and Devlin recognized the mission of improving end-user friendliness as new market opportunity. Brian ever blogged about their founding story that "*BYU used Blackboard as their LMS, and we were so frustrated with the product both as students and as TA's, that we decided to poke around that market a little more*" (Whitmer, 2010). Devlin ever commented about their expectations of end-user friendliness as that "*a teacher or a student is not necessarily a technologist. They need to be able to focus on what they're trying to do, not the tool itself. Anyone familiar with Web applications, knows how to use Instructure (Canvas)*" (Israelsen-Hartley, 2010).

The product was later turned into the routines of product innovation for Canvas LMS. The higher education technology analyst – Michael Feldstein observed the opposite of Desire2Learn's product innovation priority from Instructure that "*they're (Instructure, Inc.) not focusing particularly on open education or analytics or any other hot topics in online education, although they are aware of these and do pay some attention to them. Rather, they are looking at core use cases and trying to make them as simple as possible, throwing out some outdated LMS design assumptions in the process*" (Feldstein, 2010b). Instructure CEO and co-founder, Josh Coates, also said that about Canvas LMS that "*a lot of feedback we've gotten is that people switch to Canvas because we're easier to use*" (Wan, 2014b). The Canvas LMS did put more weights on end-user friendliness.

End users were also prioritized in the development process of Canvas LMS. As blogged by Brian Whitmer that "*Instead of starting to write code, which both of us loved doing, we took all our ideas and built them into a mocked-up version of the product in PowerPoint. Then we started calling schools. We would cold-call the CTO, CIO or the head of Instructional Design and tell them we were a new company who wanted to show our thoughts on the future of the LMS and get their feedback as well. We had a very favorable response, and met with eighteen universities over the summer of 2008 including UCLA, Berkeley, UNLV, UVU, Westminster and USC. Everyone loved what we were doing and gave us great feedback. After each school we'd write down a ton of notes, re-work the PowerPoint and go at it again. We learned a TON and ended up with a very compelling product*" (Whitmer, 2010). This approach was the opposite to that of Blackboard and Desire2Learn which both prioritized function over end-user issues as the focal points of product development.

The overlooked and compromised end-user friendliness depressed the teachers and students, which caused the disruption from the user-friendly Canvas LMS. From 2013 to 2016, Desire2Learn kept losing its long-term clients to Canvas (Chioreanu, 2005a; Pfeifer-Lukett,

2015a; Iowa University, 2016; LISTedTECH, 2016; LMS Evaluation project team, 2016). Wisconsin University who had been with D2L since 2003 switched to Canvas based on the its better usability perceived by faculty and better reliability based on cloud technology (Wong, 2013; Pfeifer-Lukett, 2015b, 2015a). Ohio State University, used Desire2Learn since 2005, went for Canvas in 2016 for the useful function, ease-to-use and clean user-interface of Canvas LMS (Chioreanu, 2005a; Office of Distance Education and elearning, 2015; Ramos, 2016b). Iowa University, another long-term client of Desire2Learn, migrated to Canvas in 2016, for its feature usability and effectiveness (Chioreanu, 2005b; Iowa University, 2016).

However, the disruption from Canvas over Desire2Learn may finally became a more theoretical repetition than literal repetition of Moodle's disruption over Blackboard. In 2016, the arrival of Cheryl Ainoa helped D2L in disputing LMS clients with Canvas by improving the utility and usability of D2L LMS (Ainoa, 2017). Cheryl was previously working for Yahoo in its global marketing sector, so the long-time working in the global marketing sector slide her into the habit of being very customer-engaging and always consider product development as a process of constant trial-and-go between R&D staff and customers (Michael, 2013; Phill Hill, 2016; Ainoa, 2017). Instead of pushing newly developed or acquired functions and features towards clients as done in the bygone years, D2L turned to tune in the voices of end-users at every stage of product development and prioritized feature development to make product more usable and useful from end-users' perspective (Phil Hill, 2017b). The improved usability and utility of D2L's LMS and features enabling personalized learning did receive immediate positive feedback. According to the data of LISTtech, D2L was equivalently competitive as Canvas in acquiring new North-American higher education clients in the first half of 2017 (Phill Hill, 2017).

Comparatively, the disruption from Canvas over Blackboard was more literal than theoretical repetition regarding the antecedents and consequences of mission prioritization overshooting.

Like Desire2Learn, Blackboard attached more importance to get learning management online than being end-user friendly. Over years, Blackboard had followed the product development process prioritizing feature design over usability. Roger Riddell, a reporter ever visited the user experience team of Blackboard, reported the product development process of Blackboard as "*long-form usability studies near the end of feature development*" (Riddell, 2013). The product development process again prioritized feature development over usability. Moreover, the product mission routine prioritizing LMS features over end-user friendliness also embedded in the business model of Blackboard in charging extra for additional feature delivery (Harper, 2006; Whitmer, 2018).

The compromised usability dissatisfied teachers and students who made a voice in their institutions pilot report of different LMS, which contributed to the disruption from Canvas in the markets of Blackboard valuing usability. University of Missouri moved from Blackboard to Canvas largely because of the better usability (Technology Evaluation Subcommittee, 2016) University of Wisconsin – Madison and University of Nebraska Omaha migrated from Blackboard to Canvas for its better usability and simplicity perceived by teachers and students than Blackboard (Morrill *et al.*, 2015; UNO Canvas Task Force, 2017). From 2015 to 2017, Canvas outshone all other LMS in taking market shares from Blackboard LMS (Phil Hill, 2017a, 2017c). In 2008, Canvas LMS became the first LMS overtaking Blackboard in the American Higher Educational Sector (McKenzie, 2018).

The above comparative cases evidenced about the antecedents and consequences the overshooting associated with meta-routine mechanism. The product missions generated in all the four sampled LMS companies became the sources of routines embedded in the product innovation, development, business model and possibly other organizational practices. As the concept routines prioritizing certain product missions for learning management system innovation, other product missions were overlooked or even compromised. As the overlooked

and compromised missions were particularly demanded by certain customers of incumbent, disruptive innovations then built upon the overlooked or compromised dimensions of LMS to disrupt the incumbent LMS and its company in the market with prioritized demand on the overlooked or compromised performance characteristics by incumbents.

However, improving the performance characteristics alternative to the core performance characteristics of incumbent product is only part of the process of disruption, a more complete disruption would not be achieved if the disruptor cannot be ambidextrous at both the incumbent and alternative product performance characteristics (Adner, 2002; Christensen, 2006a; Henderson, 2006; Tellis, 2006). The next section will shed lights on this issue by using comparative cases to illustrate the antecedents and consequences of another underlying mechanism of overshooting – Self-reinforcement.

### 4.3.2. Overshooting Associated with Self-reinforcement Mechanism

Another mechanism associated with overshooting is 'self-reinforcement' which means a process or a pattern of practices persistently reproduces itself and automatically sustained itself based on a sort of positive return generated from the process or the pattern of practice itself (Sydow, Schreyögg and Koch, 2009; Schreyogg and Sydow, 2011). Previous research evidenced that the positive feedback could exist between companies' resource allocation and its most profitable customers, which may drive the companies to overdrive its resource commitment to those profitable customers and failed to commit resources to the less profitable ones (Christensen and Bower, 1995). In this case, the self-reinforcement mechanism existed between the product lines and the product missions needed by the customers of a company.

The Table 12 as below summarizes the antecedents and consequences of overshooting associated with self-reinforcement mechanism. The overshooting associated with self-reinforcement is market penetration overshooting which indicates that the overshooting is

induced by the constant execution of market penetration as growth strategy. The antecedent of market penetration overshooting is the self-reinforcement between the product line and the market targeted by incumbent. The consequence is market development disruption which means disruptors adapt its product line to the needs of customers targeted by incumbent. Table 12 displays the theoretical relationships between the antecedents and consequences of market penetration overshooting as well as the case data supporting the theoretical relationships.

In the Blackboard case, the product-market strategy mainly adopted by Blackboard, Inc. for its LMS market is "*to increase company sales without departing from an original product-market strategy*" (Ansoff, 1957 p.114). In the 2010s', Blackboard's dominant product-market strategy in the LMS market was to penetrate the market by selling or upselling LMS features to as many institutions as possible and to charge for feature delivery, which proved to be once-successful by turning a humble start-up into the market leader of American LMS market in 2006 (Burn, 2006; Harper, 2006; Farmer, 2008a). However, the market penetration strategy did not change Blackboard's product line – fully featured LMS and Blackboard's product mission – online learning management. Instead, they are reinforced with each other. The product line is defined as "*the physical characteristics of the individual product and the performance characteristics of the products*"(Ansoff, 1957 pp.113-114).

**Table 12:** ***Antecedents and Consequences of Overshooting Associated with Self-reinforcement Mechanism***

| LMS | Product-Market Reinforcement | Market Penetration Overshooting | Market Development Disruption |
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| **Blackboard** | **Self-reinforcement between Existing Product Line (Fully Featured LMS) and Existing Mission (Online Learning Management):** "We sailed through the blowup, because our business model was, Let's sell software and get clients to buy more". "Longer term, what I think the opportunity is here is to share best practices and technology between Angel and Blackboard and bring to [Angel's] user community great new features [and] functionality and to take some of the best of the Angel features [and] functionality to the Blackboard community," said by Michael Chasen, Co-founder and Former CEO of Blackboard, Inc.(Nagel, 2009; Buchanan, 2012).<br><br>From 2000 to 2010, Blackboard LMS doubled client number to 3300 by integrating with WCB LMS and obtained 65 clients including London Business School through incorporating Prometheus LMS (Licamele, 2002b), gained around 1400 clients by merging with WebCT LMS and another 400 clients by incorporating Angel LMS (Nagel, 2009). By contrast, from 2002 to 2010, its R&D, marketing and General and Administrative expenses were all kept in stable proportion to total revenue while selling prices kept increasing along with its absorption of more and more LMS features from rivals (Blackboard Inc, 2005b, 2010; Farmer, 2008a, 2008b) | **Market Penetration Overshooting: Inadaptable Product Lines of Blackboard (Fully Featured LMS) to that of Canvas (End-user-friendly Featured LMS):** "We're focusing almost entirely on learners. That's a fairly courageous thing to say, given that they don't pay us a dime. It's not something we were doing before — we used to build products for IT and administrators," said by Jay Bhatt – Former CEO of Blackboard, Inc. (Hensley-Clancy, 2015).<br><br>**Market Penetration Overshooting: Conflicts between the Product Lines of Blackboard (Fully Featured LMS) and Moodle (Adaptively Featured LMS):** "Blackboard offers full customer service and support, something you will not get with an open source product. And as far as product development goes, I have 100 developers working for me now. We have yet to lose in a bake-off to open source and I don't expect that we will", said by Michael Chasen – Co-founder and Former CEO of Blackboard, Inc. (Burn, 2006).<br><br>**Market Penetration Overshooting: Conflicts between the Product Lines of Blackboard (Mission-inextensible LMS) and Desire2Learn (Mission-extensible LMS)**: "Those are all things that have to be linked because we have this holistic portfolio of tools that are meant to affect the entire teaching and learning spectrum, and we weren't really doing that," said by Jay Bhatt – Former CEO of Blackboard, Inc. (Overly, 2014). "Somewhere along the line, Blackboard felt like they invented the LMS, and they stopped innovating the actual system," said by Jay Bhatt – Former CEO of Blackboard, Inc (Hensley-Clancy, 2015). | **The Encroachment from Rival LMS into Blackboard's Mainstream Market:** The market share of Blackboard LMS have kept increasing as Blackboard acquired rival LMS including WCB and Prometheus (Licamele, 2002b; Harper, 2006), and peaked as it acquired WebCT in 2006 (Flook, 2013b). However, since then to the year of 2012, Blackboard's market share shrank from 71% to 44.8% in the higher education sector of American LMS market whereas D2L's market share expanded from 2% to 11.1% (K. C. Green, 2010; K. C. C. P. Green, 2012), Moodle's market share rose from 4.2% to 20.1% (K. Green, 2012) from 2006 to 2012, and Canvas started from scratch to 4.6% in three years' time after inception (K. Green, 2012). From 2011 to 2016, Canvas, Moodle and Desire2Learn were the top three LMS to which Blackboard and its acquired LMS adopters migrated in accordance with the data from LISTedTECH (Phil Hill, 2016b). |

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| **Moodle** | **Market Development through Adapting Product Line (the Bypass Capability of Moodle) to New Mission (Online Learning Management)**: "Moodle HQ currently employs 45 people, which includes about 25 coders plus testers, user experience, designers, managers and so on, located in Australia, Spain, Canada, and the UK. In addition to development we do ourselves, we also review and integrate work from between 150 and 300 community developers per release... Our Moodle Partners network consists of over 80 certified companies around the world (including some very large ones) who provide paid custom services, training, hosting and a variety of other support activities around the Moodle platform. Moodle Partners provide 10% royalties towards our open source project. Our Moodle Partners are integral to making our project sustainable", said by Martin Dougiamas – Founder and CEO of Moodle Pty Ltd (Watkins, 2016). | **Product Mission Synergy for Market Development (Online Learning Management + Customizable LMS)**: "Moodle has become a key part of operations for leading education institutions such as Open University UK, Monash University, California State and Columbia Universities, as well as big organizations such as the United Nations, UK Government, and US Defense force. But it can also be used by your local high school", said by Martin Dougiamas – Founder and CEO of Moodle Pty Ltd (Watkins, 2016).<br><br>**Product Mission Synergy for Market Development (Online Learning Management + Customizable LMS): "**Moodle and Blackboard Learn 9.1 offer very similar features and user experiences, as well as comparable prices of operation…Moodle is an open-source platform, which means there is no vender-supplied support plan, although an extensive online presence and network of active administrators is available, as well as third-party Moodle support services which can be purchased in the future. Blackboard Learn's licensing fees include software support, but the tenuous nature of Learn 9.1's future makes organization autonomy an uncertain proposition", reported by Coastal Carolina University on choosing between Blackboard and Moodle LMS (Hayes, 2016 p.8). | **Institutions Migrated off Blackboard for Moodle's Market Development:** Wabash College, North Carolina Community College System, Idaho State University and Elon University migrated from Blackboard to Moodle, citing the forced termination of WebCT or Angel as the cause of their migration while appreciated the customizability of Moodle to restore their preferred LMS without compromising their intended mission of putting learning management online. Also, they found insignificant difference between the features of Blackboard and Moodle (Instructional Technology Resource Center, 2006; Weaver, 2008; Randall, Sweetin and Steinbeiser, 2009; Tynes, 2011). |
| **Canvas** | **Market Development through Adapting Product Line (Bypass Capability of Canvas) to New Mission (Online Learning Management)**: "All the "easy to use", "end-user-oriented" claims felt like hackneyed platitudes. The truth is what we built was a fresh take on the LMS, starting with students and teachers and grand instructional design ideas instead of with administration and management. Devlin Daley and I were fresh out of college, we felt the pain on the student side and as TAs, and we picked the brains of every teacher we | **Product Mission Synergy for Market Development (Online Learning Management + End-user-friendly LMS)**: "Third party integrations have existed, but they've required the IT department to make them work. With Canvas App Centre, anyone—even students—can install an app in a single click and start to personalize the learning experience", said by Brian Whitmer – Co-founder and Former CPO of Instructure, Inc (Empson, 2013b). | **Institutions Migrated off Blackboard for Canvas' Market Development:** Brown University left Blackboard-acquired WebCT to Canvas partially for the end-user-friendly features of Canvas including convenient notifications via Facebook, Twitter, email or text message (Luthra, 2011); Missouri University reported the better usability and reliability of Canvas perceived by faculty and students as it migrated off Blackboard (University of |

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| | could find…Sometimes this caused problems because we still had customers pushing from the management side, but almost always we fenagled a workaround that didn't compromise on "making tleaching and learning easier" ", blogged by Brian Whitmer – Co-founder and Former CPO of Instructure, Inc (Whitmer, 2018). | **Product Mission Synergy for Market Development (Online Learning Management + End-user-friendly LMS)**: "Launched in 2011, Instructure Canvas is the newest of the LMS platforms. As such, one might expect Canvas to lag behind both Blackboard and Desire2Learn when it comes to breadth and maturity. Figures 2 and 3, however, tell a different story…when low priority items are taken out of the equation, Blackboard loses its edge over Canvas in the remaining categories, except in the area of Content Creation, Management, and Reuse where Blackboard is decidedly stronger", written from Indiana University LMS Pilot Report, USA (UITS Learning Technologies Functional Requirements Committee, 2013) | Missouri, 2015); Indiana University migrated off Blackboard for Canvas offered more useful and usable functions to end-users (UITS Learning Technologies Functional Requirements Committee, 2013). Cornell University migrated by preferring Canvas's intuitive-to-use to Blackboard' outdated design (DeShong, Vanderlan and Brannan, 2018). Those institutions were long-term mainstream clients for Blackboard. |
| **Desire2Lern** | **Market Development through Adapting Product Line (LMS Incorporating Data, Analytics and Predictive Model) to New Mission (Personalized Learning)**: "In our case, making learning more personal engages those students, helps them achieve better results, and we're now seeing that show up in the research we've done over the last couple of years", said by John Baker – Founder and CEO of Desire2Learn (Reinhart, 2014).<br><br>"we are seeing the traditional textbook move to digital; you're going from a one-size-fits-all education model to a very personalized one; one that fits each individual. So, that means we have to provide data, analytics and understanding, and build predictive models, and make sure each student is successful", said by John Baker – Founder and CEO of Desire2Learn (Reinhart, 2012c). | **Product Mission Synergy (Online Learning Management + Personalized Learning) for Market Development:** "the Knowillage acquisition is strategic for Desire2Learn as it adds an adaptive learning engine to our integrated learning platform…we're not going to force other Knowillage customers to switch to Desire2Learn", said by John Baker – Founder and CEO of Desire2Learn (Wan, 2013)<br><br>**Product Mission Synergy (Online Learning Management + Personalized Learning) for Market Development: "**Broadbent's university had previously delivered course content using Blackboard Learn, the world leader in what are known as learning management systems. But in 2011, it switched to Brightspace, made by Kitchener, Ont., company D2L. Broadbent saw that Brightspace shares basic features with Blackboard, but it has unique functions that let her personalize the learning experience for her students. It checks for warning signs that a pupil is falling behind—if he or she hasn't logged in or posted on the class discussion board recently, for example—and sends a friendly, cautionary note"，reported by Sarah Barmak about the Personalized Learning Capability of Desire2Learn (Barmak, 2015). | **Institutions Migrated off Blackboard partially for D2L's Market Development**: McMaster University and Rose State College left Blackboard-acquired WebCT for Desire2Learn mainly due to the unstable support, high price and feature sophistication after the acquisition of WebCT by Blackboard (Meyer, 2008; Schaffhauser, 2010). Wisconsin University, Colorado University at Boulder, and Surrey University migrated from Blackboard to Desire2Learn partially for its features supporting new missions including learning repository, e-portfolio and personalized learning functions (Kempfert, 2003; McLeod, 2011; Schaffhauser, 2011). Suffolk University left Blackboard for D2L given its modern interface, responsive design and personalized learning (Townsend and Jamieson, 2018). |

The initial success of Blackboard's market penetration strategy was because the American LMS market was yet to be explored. The co-founder and former CEO of Blackboard – Michael Chasen ever said that "*originally though, this was an industry where none of the schools were using technology. When we went out and had an 80% market share, it wasn't because we were stealing that market share. Schools were doing it for the first time, which is why we became the market leade*r" (Karpowicz, 2017). The major tacit adopted by Blackboard to explore the LMS market was through merger and acquisition which brought in new market shares for up-selling and cross-selling its feature-ridden Blackboard LMS (Harper, 2006; Gilus, 2007; Farmer, 2008a, 2008b; Straumsheim, 2017). Just as the Michael Chasen ever commented that "*We sailed through the blowup, because our business model was, Let's sell software and get clients to buy more*" (Nagel, 2009). As institutions never adopted technologies, the improved utility based on LMS technology was tremendous and LMS feature delivery was welcomed by institutions as important product metric.

The market penetration strategy was evidenced by Blackboard's aggressive market expansion but not so aggressive input expansion. From 2000 to 2010, Blackboard LMS doubled its client number to 3300 by integrating with WCB LMS and obtained 65 clients including London Business School by incorporating Prometheus LMS (Licamele, 2002b), gained around 1400 clients by incorporating WebCT LMS and acquired 400 clients by incorporating Angel LMS (Nagel, 2009). By contrast, from 2002 to 2010, the Research and Development cost never went beyond 14% of the total revenue (Blackboard Inc, 2005a; Blackboard Inc., 2010). Sales and marketing expenses, and General and Administrative expenses were all kept in stable proportion to total revenue (Farmer, 2008a; Blackboard Inc, 2010).

However, the positive return by executing market penetration strategy were dwindling since 2006. The market share of Blackboard LMS have kept increasing as Blackboard acquired rival LMS including WCB and Prometheus (Licamele, 2002b; Harper, 2006), and peaked as it

acquired WebCT in 2006 (Flook, 2013b). However, as Blackboard consolidated WebCT and Angel in 2006 and 2009, Blackboard's market share shrank from 71% to 44.8% in the higher education sector of American LMS market from 2006 to 2012. The failure of market penetration was because of rival companies' encroachment into the mainstream market of Blackboard. From 2006 to 2012, D2L's market share expanded from 2% to 11.1% (K. C. Green, 2010; K. C. C. P. Green, 2012), Moodle's market share rose from 4.2% to 20.1% (K. Green, 2012), and Canvas started from scratch to 4.6% after three years of inception (K. Green, 2012).

By comparing the data, the successful encroachment from rival competitors was actually driven by the rivals' leveraging of its flexible product line to invade into Blackboard's mainstream market while Blackboard was incapable of counteracting for its product line has been reinforced with needs of its mainstream market. Blackboard's mainstream market was accommodated by its product line based on the product mission – Online Learning Management. The product line fulfilling the mission of online learning management later became organizational rigidity overlooking and compromising the missions fulfilled by the product lines of rival competitors like Moodle. Conversely, Moodle did not have the product line rigidity holding them back to perform the missions performable by Blackboard's product line, which enabled them to make inroads into the mainstream market of Blackboard.

The extendibility of a rival product line to perform incumbent's product mission is derived from the bypass capability of the rival product line. As previously analysed, the product lines of Blackboard tended to overlook and compromise the product mission of Moodle – customizable LMS. Moodle LMS later built upon a new product line to make LMS customizable. However, Moodle did not confine itself to be a highly customizable but poorly featured LMS. Instead, it leveraged the its product line supporting customizability and other capabilities to bypass the rigid product line of Blackboard to improve LMS features which previously improved by the product line of Blackboard. The founder and CEO of Moodle ever

described Moodle's bypass capabilities as that "*Moodle HQ currently employs 45 people, which includes about 25 coders plus testers, user experience, designers, managers and so on, located in Australia, Spain, Canada, and the UK. In addition to development we do ourselves, we also review and integrate work from between 150 and 300 community developers per release... Our Moodle Partners network consists of over 80 certified companies around the world (including some very large ones) who provide paid custom services, training, hosting and a variety of other support activities around the Moodle platform. Moodle Partners provide 10% royalties towards our open source project. Our Moodle Partners are integral to making our project sustainable*" (Watkins, 2016).

The capability bypassing the product line rigidity of incumbent to support the missions fulfillable by incumbent product line is here referred as bypass capability. The bypass capabilities are likely to derive from the part of disruptive product lines for the reprioritized missions advocated by disruptor. For example, the open source LMS, amateur developers and Moodle Partners around the world were originally the part of Moodle product lines to support the reprioritized mission of Moodle – customizable LMS (Dougiamas, 2007). However, those product lines later contributed substantially to the LMS feature delivery of Moodle. Also, the bypass capabilities could be partially extended from the incumbent product lines. For example, Moodle HQ also employed 45 people to develop and maintain Moodle, just like the in-house developers and staffs of Blackboard, but which were not rigid to compromise customizability.

After building up the bypass capability to resolve the trade-off between new product mission and established product mission, Moodle LMS begun to have the extendibility of fulfilling two product missions – well-featured LMS and customizable LMS. Being ambidextrous at high customizability and feature delivery, Moodle LMS became capable of equipping customers with the synergy of the two product missions. Product mission synergy does not only manifest itself as the ambidexterity of two product missions but also as the better absorbable product

mission resulted from the complementarity from another product mission. For example, customers migrated from Blackboard to Moodle were not only accessible to the LMS features similar to Blackboard LMS but also could switched to further customize the features at a lower cost than before. More importantly, the high-end or mainstream customers of Blackboard LMS now can absorb the myriad of LMS features less costly and more suitably by switching to Moodle LMS.

The product mission synergy enabled Moodle to execute market development strategy. Market development strategy is defined as "*a strategy in which the company attempts to adapt its present product line to new missions*" (Ansoff, 1957 p.114). For Moodle, the new mission was online learning management or well-featured LMS and the adapted product line was the bypass capability of Moodle to fulfil the mission of online learning management which is a new mission in comparison with the old mission of customizable LMS. As feature-ridden LMS was mostly appealing to larger institutions, Moodle developed market from smaller institutions valuing price into the mainstream market of Blackboard LMS valuing feature sophistication (Kenneth Green, 2010; K. Green, 2012).

The market development of Moodle based on its product mission synergy is well-evidenced. In the pilot report between Blackboard and Moodle LMS by Coastal Carolina University, the comparison between the product missions was evidenced that "*Moodle and Blackboard Learn 9.1 offer very similar features and user experiences, as well as comparable prices of operation…Moodle is an open-source platform, which means there is no vender-supplied support plan, although an extensive online presence and network of active administrators is available, as well as third-party Moodle support services which can be purchased in the future. Blackboard Learn's licensing fees include software support, but the tenuous nature of Learn 9.1's future makes organization autonomy an uncertain proposition*" (Hayes, 2016 p.8). Also, the founder and CEO of Moodle – Martin Dougiamas ever evidenced about the market

development Moodle LMS from smaller institutions to larger institutions by saying that "*Moodle has become a key part of operations for leading education institutions such as Open University UK, Monash University, California State and Columbia Universities, as well as big organizations such as the United Nations, UK Government, and US Defence force. But it can also be used by your local high school*" (Watkins, 2016).

Meanwhile, Blackboard was unable to respond to Moodle's encroachment because of the product mission trade-off induced by its core rigidity for high customizability (Leonard - Barton, 1992). "*Blackboard offers full customer service and support, something you will not get with an open source product. And as far as product development goes, I have 100 developers working for me now. We have yet to lose in a bake-off to open source and I don't expect that we will*", said by Michael Chasen – Co-founder and Former CEO of Blackboard, Inc. (Burn, 2006). The full customer service and support as well as the100 developers were all proprietary, which did not only act as core competence supporting LMS feature delivery but also core rigidity repelling LMS customizability.

Given the organizational rigidity and product mission trade-off of Blackboard, Moodle begun to disrupt Blackboard by replacing Blackboard LMS in many big institutions. As Blackboard was confined by its rigidity to develop the market for high customizability, the growth of its LMS largely relied on penetrating existing market by forcing the termination of the acquired rival LMS to facilitate the upselling of Blackboard LMS. The market penetration strategy did not involve radical improvement on existing product line and hence the incremental improvement on existing product mission. Consequently, customers switched to Moodle for product mission synergy. Wabash College, North Carolina Community College System, Idaho State University and Elon University migrated from Blackboard to Moodle, citing the forced termination of WebCT or Angel as the cause of their migration while appreciated the

customizability of Moodle to restore their preferred LMS (Instructional Technology Resource Center, 2006; Weaver, 2008; Randall, Sweetin and Steinbeiser, 2009; Tynes, 2011).

As technology and market became more mature, Blackboard did acquire new product lines, including Elluminate and Wima, for radical improvement (Flook, 2010). However, the acquired product lines were either for product missions irrelevant from LMS, product lines imitable by competitors or not incorporated into Blackboard LMS (Instructional Technology Resource Center, 2006; Blackboard Inc., 2007, 2010; Lieberman, 2017; Straumsheim, 2017), which rendered the improvement on the product missions of Blackboard LMS incremental in comparison with competitors (California State University Channel Islands, 2011; Chawdhry, Paullet and Benjamin, 2011; Committee and University, 2013).

To theorize the above analyses, the product lines of incumbent company supporting existing product missions may become rigidity overlooking and compromising new product mission to be supported by different product lines. The reinforcement between incumbent product line and incumbent product missions serves as the antecedent confining incumbent company to its mainstream market by rigidifying incumbent product line. As the mainstream market may initially be a blue ocean market (Agnihotri, 2016), market penetration strategy can be successfully adopted by the incumbent company, which enabled the self-reinforcement of market penetration capability based on the positive return from the penetrated market. The self-reinforced capability for market penetration later becomes rigidified in an increasingly saturated market and the saturated customers are not willing to pay for the products with incremental product mission expansion (market penetration overshooting).

A new company may develop new product lines for new product missions but bypass the product line rigidity of incumbent company to support the incumbent product mission. As the new company has already possessed the product line supporting the new product mission, the

company's product will be with the synergy of performing the product missions of both the incumbent product mission and the new mission. Consequently, the new company may disrupt the incumbent company by encroaching from the market based on new mission into the market based on incumbent product mission (market development disruption). Essentially, the market penetration overshooting is anteceded by the self-reinforcement between incumbent product line and incumbent product mission, and consequent by disruptor's encroachment into incumbent's mainstream market based on product mission synergy.

The encroachment of Canvas LMS into the mainstream market of Blackboard LMS was another literal repetition of market penetration overshooting. Canvas LMS started from scratch to occupy 4.6% market share in three years' time after inception (K. Green, 2012) whereas Blackboard's market share declined from around 55% to 44.8% in the American higher education sector at the same time (Green, 2009; K. Green, 2012). The birth of Canvas LMS was based on Blackboard's product line rigidity for end-user friendliness, which confined Blackboard to overshoot penetrating its mainstream market – institutional buyers.

The product line rigidity was derived from the self-reinforcement between the product line of Blackboard as fully-featured LMS and the mission needed by its mainstream customers – online learning management. In previous analyses regarding mission prioritization overshooting, the product development process of Blackboard was not end-user-engaging enough by prioritizing function or feature development for institution at the front-end stage of feature development (Riddell, 2013). The prioritized mission made Blackboard overlook and compromise end-user friendliness in the product process of Blackboard. "*UX Director of Operations Andy Jacobson, who helps facilitate the team's work by helping them reach out to users, tells us that just a few years ago, the people the company talked to would have been 90% system administrators, Blackboard's main points of contact on campuses. Working through those administrators, the company made an effort to gather direct*

*feedback from students and teachers*", reported by Roger Riddell about the user experience team of Blackboard (Riddell, 2013).

The reason for Blackboard to reach out for IT administrators rather than end-users is because of the mission needed by the mainstream Blackboard clients - online learning management. IT administrators are the hubs gleaning all the needs on LMS features from end-users including faculties and students across campus, so developing products based on the feedbacks from IT administrators was more efficient for LMS feature delivery than that from end-users. Over time, the product line of Blackboard became too rigid to respond to the needs of end-users, which was not changed until the situation was later found to be mistaken. "*We're focusing almost entirely on learners. That's a fairly courageous thing to say, given that they don't pay us a dime. It's not something we were doing before — we used to build products for IT and administrators*," said by Jay Bhatt – Former CEO of Blackboard, Inc (Hensley-Clancy, 2015).

The product line rigidity gave opportunity for Canvas to build up new product lines favouring end-users. The newly developed product line included the Web 2.0 technologies including Ruby on Rails, JQuery, HTML5 and CSS3 were adopted to make the user interface of Canvas smooth and modern (Instructure Inc, 2018). Google Docs, Facebook, Twitter and other popular tools were incorporated into Canvas so that end-users can access information through their most familiar web tools (Israelsen-Hartley, 2010; Tripathi, 2015). Canvas developers also managed to reduce grading workflow to only a few clicks so as to remove the burden of teachers (Feldstein, 2010a). All those capabilities enabled Canvas LMS to perform the missions valued by end-users but not institution-wide IT administrators.

However, Canvas LMS was not only developed for end-users but was also developed to take the mission of institution-wide administration and management into consideration as well. "*All*

*the "easy to use", "end-user-oriented" claims felt like hackneyed platitudes. The truth is what we built was a fresh take on the LMS, starting with students and teachers and grand instructional design ideas instead of with administration and management. Devlin Daley and I were fresh out of college, we felt the pain on the student side and as TAs, and we picked the brains of every teacher we could find…Sometimes this caused problems because we still had customers pushing from the management side, but almost always we fenagled a workaround that didn't compromise on "making teaching and learning easier"* ", blogged by Brian Whitmer – Co-founder and Former CPO of Instructure, Inc (Whitmer, 2018). The 'workaround' was the bypass capability bypassing the rigidity of Blackboard product line to support the product missions valued by Blackboard's mainstream market.

The bypass capability manifested itself in a way of creating the synergy of performing both the missions of institution and individual end-user. In 2013, Canvas was made like iPhone to build up an App Centre for LMS users to install third party apps at their own discretion (Knighton, 2013). Although Blackboard launched such a platform for third party blocks to be built into its LMS long before, Blackboard only allow institution-wide installation or uninstallation of the blocks while Canvas removed the restriction by letting apps to be installed by end-users (Empson, 2013b). However, the app centre did not compromise app installation by institutional administrator at all.

The product mission synergy enabled Instructure to pivot its product line towards the mainstream market of Blackboard. The app centre was positively received by the faculty of Missouri University in America as they migrated from Blackboard to Canvas (Technology Evaluation Subcommittee, 2016). Another sizable American institution – Indiana University also left Blackboard to Canvas by reporting that "*Launched in 2011, Instructure Canvas is the newest of the LMS platforms. As such, one might expect Canvas to lag behind both Blackboard and Desire2Learn when it comes to breadth and maturity. Figures 2 and 3, however, tell a*

*different story…when low priority items are taken out of the equation, Blackboard loses its edge over Canvas in the remaining categories, except in the area of Content Creation, Management, and Reuse where Blackboard is decidedly stronger*" (UITS Learning Technologies Functional Requirements Committee, 2013). The report reflected that Canvas LMS offered features more important for teachers and students without compromising too much on the feature sophistication for the diversified needs of a whole institution in comparison with Blackboard LMS.

As Canvas LMS was not meaningfully worse than Blackboard LMS in serving institutions and was better than Blackboard for serving end-users. Instructure begun to disrupt Blackboard evidently in the mainstream market of Blackboard. In 2015, Pennsylvania State University moved to Canvas from Blackboard-acquired Angel after finding Canvas was functionally useful and usable (Penn State Information Technology Services and Outreach and Online Education, 2015). In 2018, Cornell University, the earliest adopter of Blackboard LMS, decided to migrate to Canvas as faculty found Canvas LMS less clunky than Blackboard LMS and agile to provide third-party tools for specific needs of Cornell faculty (DeShong, Vanderlan and Brannan, 2018 pp.i-ii). By the time of 2018, Canvas was almost replacing Blackboard to take the leadership in terms of LMS market share in the American higher education sector (McKenzie, 2018).

Although the disruption of Moodle and Canvas over Blackboard in its mainstream market were literal repetition of the market penetration overshooting, the case from Desire2Learn provided as a theoretical repetition of market penetration overshooting. Like Blackboard, Desire2learn LMS was developed based on the similar product mission – online learning management (Reinhart, 2012b). Based on the product mission, both Blackboard and Desire2learn adopted similar development process prioritizing function and feature development for institutions over teachers and students. Just as that observed by the long-term LMS industry analyst – Michael

Feldstein who ever blogged that "*the general point is that I see signs that D2L as a company tends to have an enterprise-y approach to product design, and that may have hurt them in this and other cases...In fact, Blackboard made essentially the same prioritization decision with its own retention analytics feature set. In general, the enterprise-y approach is very good at delivering features but not nearly as good at solving customer problems*" (Feldstein, 2013).

Although the similar product mission would normally lead to similar product line, Desire2learn later chosen a different product-market strategy to serve its targeted customers. Since 2012, Desire2Learn aggressively acquired product lines to incorporate new mission - 'personalized learning' which was not typical of the product missions of LMS at that time. The acquired technologies included Degree Compass – an automatic course recommendation engine, Wiggio – a group collaboration tool, and LeaP-an adaptive learning engine (Empson, 2013a; Lunden and Empson, 2013; Virginia, 2013). Unlike Blackboard, Desire2Learn did not charge much extra for the new mission of personalized learning and force customers to buy. It was a market development strategy by adapting product line to new mission – personalized learning.

Nevertheless, although 'personalized learning' was an end-user-concerned feature, Desire2Learn's product line still prioritized institution buyers over end-users, which refrained the mission of personalized learning from being fulfilled by end-users. John Baker, founder and CEO of Desire2Learn, kept close track of new technologies to accommodate educational trends. Just as he said in an interview that "*we are seeing the traditional textbook move to digital; you're going from a one-size-fits-all education model to a very personalized one; one that fits each individual. So, that means we have to provide data, analytics and understanding, and build predictive models, and make sure each student is successful*" (Reinhart, 2012c). However, the newly developed personalized learning feature of Desire2Learn was observed by Phil Hill, a California-based educational technology consultant and market analyst, as end-

user-frustrating and he ever blogged that "*in the past D2L has seemed too interested in being able to do some chest-thumping "We've got CBE. We've got Predictive Analytics. We've got Adaptive Learning." while missing something on what current and even prospective customers need in their daily lives*" (Phill Hill, 2017).

The failure in making the personalized learning performable and usable by the end-users curtailed the fulfilment of the mission performance needed by teachers and students, which gave opportunity for Canvas to invade based on its better end-user friendliness. In 2014, the University of Oklahoma was struggling with the integration of its data with D2L product and the difficulty in data analytics was also found by other clients (Michael, 2013; Oklahoma University, 2016b). The inferior usability of its core LMS was propelling its long-term clients to leave for Canvas. In 2016, University of Colorado Boulder switched to Canvas for its "ease of use and intuitiveness, mobile friendliness, and open-core architecture allowing flexibility" (LMS Evaluation project team, 2016; Pfeifer-Lukett, 2016). Also, Missouri University and Cornell University selected Canvas over Desire2Learn to migrate from Blackboard for the better end-user friendliness of Canvas (University of Missouri, 2015).

Nevertheless, Blackboard was not as end-user-friendly as Canvas, which left out opportunity for Desire2Learn to encroach into the mainstream market of Blackboard. As Blackboard adopted market penetration strategy, Blackboard did not actively improve its LMS by using new technologies radically changing its product line. Instead, it largely acquired new customer base to distribute its existing Blackboard LMS. By contrast, Desire2Learn rarely acquired for product distribution but for innovations to improve its LMS. For example, when Desire2Learn acquired Knowillage to improve its personalized learning, John Baker said "*the Knowillage acquisition is strategic for Desire2Learn as it adds an adaptive learning engine to our integrated learning platform…we're not going to force other Knowillage customers to switch to Desire2Learn*" (Wan, 2013).

One drawback of market penetration is that it only endows existing product mission with sustaining improvement. Blackboard tended to acquire rival LMS to obtain distribution channels and charged extra on the added features from the rival LMS incorporated into its LMS under its market penetration strategy. As the American LMS market structure became increasingly mature and oligopolistic (Blackboard Inc, 2005a; Nagel, 2009), incorporating a similar rival LMS into Blackboard LMS only improved the existing product missions performed by Blackboard LMS but did not radically add to product missions performance. In spite of the diminishing utility generated from additional LMS features, Blackboard kept market penetration by charging premium price for the Blackboard LMS incorporated rival LMS features (Meyer, 2008; Farmer, 2008a) and terminating the acquired LMS (Nagel, 2009; Straumsheim, 2014b), which made institutions' up-buying of Blackboard LMS more unworthy.

Conversely, the market development strategy equipped Desire2Learn LMS with new product mission performances but not with much increase in price, which provided as a contrast with the incremental improvement on the product mission performance of Blackboard LMS embodied as the valueless feature creep and bad value-for-money of Blackboard LMS. Therefore, the better featured and cheaper Desire2Learn LMS encroached into the mainstream market of Blackboard. McMaster University, Surrey University, and Rose State College left Blackboard-acquired WebCT for Desire2Learn mainly due to the unstable support, high price and feature sophistication after the acquisition of WebCT by Blackboard (Meyer, 2008; Schaffhauser, 2010, 2011). Wisconsin University, Colorado University at Boulder, and Surrey University migrated from Blackboard to Desire2Learn also partially for its new features including learning repository, e-portfolio and personalized learning functions (Kempfert, 2003; McLeod, 2011; Schaffhauser, 2011).

Blackboard did acquire some new features that could be leveraged to add new missions to Blackboard LMS, like the acquisition of Elluminate and Wima (Flook, 2010). However, as

Blackboard product line has been reinforced for the high market growth based on its previous blue ocean market penetration, Blackboard kept charging extra for the acquired features (Flook, 2013a; Overly, 2014; Ascione, 2015; Lapowsky, 2015a). The extra charges held customers back to experience the product mission synergy of Blackboard LMS because clients found it unworthy to buy or upgrade. The product line emphasizing high market growth was partially shaped by the expectation of investors for rapid market growth because Blackboard would lose support from the financial market if it did not sustain high growth as before (O'Neil, 2014; Overly, 2014; Doherty and Ronalds-Hannon, 2018; Hill, 2018b). The investors acted as part of the rigidified product line holding Blackboard back from the market development.

As Blackboard's product lines were rigid in adding new missions to its LMS, Jay Bhatt – Former CEO of Blackboard, Inc ever commented that "*somewhere along the line, Blackboard felt like they invented the LMS, and they stopped innovating the actual system*" (Hensley-Clancy, 2015). As Jay realized the problem, he later changed its market penetration strategy into market development strategy through integrating Blackboard's acquired technologies supporting new missions by saying that "*those are all things that have to be linked because we have this holistic portfolio of tools that are meant to affect the entire teaching and learning spectrum, and we weren't really doing that*" (Overly, 2014). By bounding different technologies and their supported product missions together, Blackboard adapted its product lines for new missions.

To theorize the above analyses, the success of exploiting a market works as the positive return to reinforce incumbent's product line supporting its current product missions needed by existing customers who, in return, generates further positive return to reinforce the product line. The self-reinforcement between existing product line and product mission is only sustainable when the market is not saturated. However, the self-reinforcement becomes stumbled as market become increasingly saturated because further penetrating a saturated market by using the same

product line cannot bring in significant growth. The saturated customers or repeated buyers will find the further improvement on existing product mission incremental under market penetration strategy (Market Penetration Overshooting). The market penetration overshooting will give opportunity to disruptors able to develop from its targeted markets into the mainstream markets of incumbent by using bypass capabilities (Market Development Disruption).

As disruptors encroached into the mainstream market, incumbents could no longer sit still and await destruction. One strategy shared by many incumbents to counteract disruptors is through emulating disruptive innovation (Markides and Charitou, 2004). However, many failed to do so because of various organisational factors including paralyzed competence, organizational architecture inertia, dominant logic, routine rigidity or business model conflicts (Rebecca and Kim, 1990; Bettis and Prahalad, 1995; Markides and Charitou, 2004; Gilbert, 2005; Henderson, 2006).

In order to avoid those organisational factors, management researchers tended to propose to emulate disruptive innovation in a business unit completely separate from the incumbent (Christensen, 1997; Gilbert, 2005; Henderson, 2006) while others suggested to integrate incumbent's present capabilities with the capabilities emulating disruptor is sometimes better than emulating in a completely new unit (Markides and Charitou, 2004). For example, the emulation on online broker by traditional offline broker is not necessarily conducted in a company competently independent of the traditional offline broker for there are many resources sharable between the online and offline brokers. The following analyses will shed light on how different stakeholders act through the 'lock-in' mechanism to refrain incumbent's emulation from succeeding and show evidences regarding a new form of emulative strategy other than pure separation and integration.

### 4.3.3. Overshooting Associate with Lock-in Mechanism

One commonplace response to disruptive innovation is through the emulation on disruptors. However, the value network outside and capabilities inside an incumbent may exert lock-in effects and refrain the emulative efforts from being paid off, so a business unit completely separated from incumbent for the emulative strategy is suggested (Christensen and Raynor, 2003). Nevertheless, the evidences collected for this research emphasize that the success of emulation strategy is largely contingent on the fit between the different stakeholders of incumbent and incumbent's emulation on disruptors, which implies more about the emulative strategies than pure separation or integration.

Table 13 illustrates that the overshooting associated with lock-in mechanism is misfit overshooting. Misfit overshooting is caused when the emulation on disruptive innovation conflicts with incumbent itself, incumbent's mainstream customers and investors. The type of overshooting is caused by incumbent's corrective emulation on disruptors and consequent by disruptive innovation based on its better fit with disruptor itself and its value network.

As disruptive LMS encroached into the mainstream market of Blackboard LMS, Blackboard begun to fend off by emulating the disruptors since 2012. Since 2012, after 6 years' consecutive decline of LMS market share from 71% to 44.8% in America, Blackboard, Inc. replaced its CEO with Jay Bhatt to initiate a series of corrections over the past wrongdoings of Blackboard (Feldstein, 2013; Flook, 2013a; Overly, 2014; Straumsheim, 2014a; Lapowsky, 2015a). Ready to bring radical correction to Blackboard, Jay Bhatt said "*I didn't come here to maintain the status quo. I came here to change the trajectory of the company and its interaction with the industry*" (Flook, 2013b).

**Table 13:** ***Antecedents and Consequences of the Overshooting Associated with Lock-in Mechanism***

| LMS | Corrective Emulation | Misfit Overshooting | Fit Disruption |
|---|---|---|---|
| **Blackboard** | **Radical Correction**: Since 2012, after 6 years' consecutive decline of LMS market share from 71% to 44.8% in America, Blackboard, Inc. replaced its CEO with Jay Bhatt to initiate a series of corrections over the past wrongdoings of Blackboard (Feldstein, 2013; Flook, 2013a; Overly, 2014; Straumsheim, 2014a; Lapowsky, 2015a).<br><br>"I didn't come here to maintain the status quo. I came here to change the trajectory of the company and its interaction with the industry," said by Jay Bhatt – Former CEO of Blackboard, Inc (Flook, 2013a). | **The Misfit between Incumbent's and Disruptor's Different Value-added Activities and Stakeholders:** Blackboard's previous operations and market environments, including the latent needs of LMS markets, product mission of Blackboard LMS, fast time-to-market, active financing for the merger & acquisition, horizontal Integration of products and markets, and customers willing to pay for new functionality, are fitting each other as an organic system. In contrast, blackboard's emulative operations and new market environments, including expressed needs of LMS, innovator's pain point, slow time-to-market, Vertical Disintermediation between product and market, growth based on internal innovation and customers willing to pay for usability or unwilling to pay as much for functionality, are not fitting the previous operations and market environments of Blackboard and hence reject effects (Stephen, 2000; The Entrepreneur Center@NVTC, 2005; Overly, 2014; Rogers, 2014; Phil Hill, 2016a; Dent, 2018). | **Superior Performance of the Disruptive Product Mission upon Better Fit**: Moodle, Canvas and Desire2Learn rarely emulated exogenous operations/markets to change their organic operations/markets. Their bypass capabilities fit well with their internal operation, external market and investors to reinforce the performance of their unique product benefits. In contrast, Blackboard actively emulated exogenous capabilities mis-fitting with its endogenous internal operation, external market and investors. The misfit undermined the performance of Blackboard's emulation on disruptors and hence the continuing disruption from those based on better fit (Serge A. Rijsdijk, Langerak and Jan Hultink, 2011; Technology Evaluation Subcommittee, 2016; Jamieson, 2017b, 2017d; Temple University LMS Selection Committee, 2017; Dent, 2018; Lieberman, 2018) |
| **Moodle** | **Emulating Moodle as the Correct**: In 2012, Blackboard acquired two of Moodle Partners – MoodleRooms in the US and NetSpot in Australia and begun to provide hosting support service to Moodle users (Kolowich, 2012b, 2012a). | **Misfit between Incumbent and its Emulation on Disruptor**: Blackboard terminated its Moodle Partnership with Moodle in 2018 for the misfit between them: In American market, Blackboard was restrained from promoting Moodle even it acquired the largest Moodle Partner in America in the fear of cannibalizing Blackboard LMS business (Feldstein, 2017b); Blackboard intended to sell its extension products including Blackboard Ally, SafeAssign and Collaborate alongside Moodle LMS, which was refused by Moodle HQ (Dent, 2018; Lieberman, 2018); The financial contribution to from Blackboard-acquired Moodle Partners to Moodle HQ had been declining while those Moodle Partners' business were actually expanding (Dent, 2018; Doherty and Ronalds-Hannon, 2018). | **Disruption from Moodle upon Better Fit:** by the time the partnership between Blackboard and Moodle was terminated due to the misfit between them, another Moodle Partner immediately received calls from the customers of Blackboard-acquired MoodleRooms, interested in migrating off MoodleRooms partially for which was no longer directly supported by Moodle headquarters and partially for certain MoodleRooms customers thought more of their money should had gone to Moodle headquarter instead of MoodleRooms (Lieberman, 2018). |

| | | | |
|---|---|---|---|
| **Canvas** | **Emulating Canvas as the Correct:** Since 2012, Blackboard Inc refocused its services on students and teachers instead of IT administrators, announced Blackboard Ultra LMS experience based on Cloud technology, intuitive interface and improved usability, put more weights on internal innovation and encouraged end-user participation for product innovation (Feldstein, 2013; Lapowsky, 2015b; Blackboard Inc, 2016; Schaffhauser, 2016). | **Misfit between Incumbent's mainstream market and its Emulation on Disruptor:** existing clients of Blackboard with high demand on feature sophistication rejected Blackboard Ultra for which did not deliver features as complete as its predecessor - Blackboard Learn 9.1(Temple University LMS Selection Committee, 2017; DeShong, Vanderlan and Brannan, 2018). Given the situation, Blackboard Ultra was restrained from being too distinct from Blackboard Learn 9.1 (Phil Hill, 2016a) and was finally offered to clients with the option of interchanging between Blackboard 9.1 and Blackboard Ultra experience (Blackboard Inc, 2016; Schaffhauser, 2016; Temple University LMS Selection Committee, 2017). Moreover, the cloud-based Blackboard Ultra was against certain existing customers' wishes to host LMS on premise and cannibalized Blackboard Learn business (Hayes, 2016; Straumsheim, 2017), Blackboard thus had to continue its on-premise LMS offer. | **Disruption from Canvas upon Better Fit:** In spite of the announcement of Blackboard Ultra in 2014, Blackboard Ultra was delayed to be available until 2016 due to further development because earlier adopters prefer a more similar interface between Blackboard 9.1 and Ultra (Blackboard Inc, 2016; Phil Hill, 2016a). The delay held Temple University, Mizzou University and Cornell University back to fully pilot Blackboard Ultra against Canvas, which made them migrated from Blackboard to Canvas although they appreciated the enhanced intuitive user-interface of Blackboard Ultra (University of Missouri, 2015; Temple University LMS Selection Committee, 2017; DeShong, Vanderlan and Brannan, 2018). |
| **Desire2Learn** | **Emulating Desire2Learn as the Correct:** Blackboard doubled investment to develop its core product – Blackboard LMS (Young, 2013); for external acquisitions, Blackboard no longer treated external acquisitions as means of eliminating rivals and acquiring revenue pipelines as before. Instead, Blackboard planned to acquire if there were true innovations to be integrated into its LMS (Empson, 2013a; Overly, 2014; Wan, 2014c). | **Misfit between incumbent's investor and its Emulation on Disruptor:** The previous way of acquiring for new revenue streams and distribution network was abandoned and the acquisitions after 2012 only brought in innovations but not as much revenue as before (O'Neil, 2014; Overly, 2014). Combined with the doubled investment into Blackboard LMS and its privatization off public financing (Buchanan, 2012; Young, 2013), Blackboard was consequently more indebted, downgraded for financial credibility by Moody and forced to consider selling its previously acquired payment-processing division (Hill, 2015b, 2018b; Doherty and Ronalds-Hannon, 2018). Also, as previous acquisitions were deviated from LMS, new acquisition including campus administration, campus transaction and campus website had to be made to enhance the competitive advantages of those non-LMS products (Wehr, 2003; Overly, 2014), which again averaged out its commitment between its LMS and Non-LMS product lines. | **Disruption from Desire2Learn upon Better Fit:** Desire2learn's fit revolved around its focus on LMS. D2L raised money through its two rounds of PE/VC financing (Wan, 2014a, 2014c). Desire2learn spent most of its financing to acquire and improve for the personalized learning and analytics capability of LMS, which did bring in positive market feedback. In 2007, Derby University and Bournemouth University in the UK migrated from Blackboard to Desire2Learn LMS largely because of its personalized learning and data analytics (Jamieson, 2017c, 2017a). Southern New Hampshire University migrated from Blackboard to D2L LMS mainly because of its personalized learning capability (Jamieson, 2017b). |

The radical correction was mainly about emulating disruptive innovations as corrective measures. To emulate Moodle LMS, In Blackboard acquired two of Moodle Partners – MoodleRooms in the US and NetSpot in Australia and begun to provide hosting support service to Moodle users in 2012 (Kolowich, 2012b, 2012a); To emulate Canvas, Blackboard Inc refocused its services on students and teachers instead of IT administrators, announced Blackboard Ultra LMS experience based on Cloud technology, intuitive interface and improved usability, put more weights on internal innovation and encouraged end-user participation for product innovation (Feldstein, 2013; Lapowsky, 2015b; Blackboard Inc, 2016; Schaffhauser, 2016); To emulate Desire2Learn, Blackboard became more focused on LMS Innovation: Blackboard doubled investment to develop its core product – Blackboard LMS (Young, 2013); for external acquisitions, Blackboard no longer treated external acquisitions as means of eliminating rivals and acquiring revenue pipelines as before. Instead, Blackboard planned to acquire if there were true innovations for education (Empson, 2013a; Overly, 2014; Wan, 2014c).

The emulations did slow down the encroachment of rival LMS into its mainstream market. In 2016, Framingham State University in Massachusetts, a long-term Blackboard client, reviewed Blackboard, Desire2Learn and Canvas but finally decided to stay with Blackboard. In 2017, another two long term clients of Blackboard – Purdue and Washington State Universities decided to continue with Blackboard for the cost of switching outweighed that of standing still. Southern New Hampshire University in USA even switched from Desire2Learn to Blackboard (Lieberman, 2017). According to the data regarding the LMS market share for US institutions from Edutechnica, the declining trend of Blackboard's market share begun to level off in 2015 (Hill, 2015a).

However, Blackboard's corrective emulations were hard to escape the misfit effects imposed by its previous value-added activities and stakeholders. Blackboard's previous operations and

market environments, including the latent needs of LMS markets, product mission of Blackboard LMS, fast time-to-market, active financing for the merger & acquisition, horizontal Integration of products and markets, and customers willing to pay for new functionality, are fitting each other as an organic system. By contrast, blackboard's emulative operations and new market environments, including expressed needs of LMS, innovator's pain point, slow time-to-market, Vertical Disintermediation between product and market, growth based on internal innovation and customers willing to pay for usability or unwilling to pay as much for functionality, are not fitting the previous operations and market environments of Blackboard and hence reject effects (Stephen, 2000; The Entrepreneur Center@NVTC, 2005; Overly, 2014; Rogers, 2014; Phil Hill, 2016a; Dent, 2018)

The lock-in manifested itself as the misfit between Blackboard's and its rivals' different value-added activities and stakeholders. Misfit is here defined as the mutually inconsistent and unreinforced value-added activities and stakeholders or the suboptimal configuration of those activities and stakeholders for an overall objective (Porter, 1996; Siggelkow, 2001). The misfit may exist both inside or outside an organization (Siggelkow, 2002) and it could exert lock-in effects on a company when it tries to emulate a different pattern of practice in trade-off with the fixed pattern (Porter, 1996).

Previous researches all support the misfit existent in the value, process and resource of an incumbent company, which makes for incumbent's difficulty in responding to discontinuous innovation based on different value, process and resource (Rebecca and Kim, 1990; Bettis and Prahalad, 1995; Tripsas, 1997; Tripsas and Gavetti, 2000; Christensen, Anthony and Roth, 2004; Reid and De Brentani, 2004; Henderson, 2006; Barnett and Pontikes, 2008; Schreyogg and Sydow, 2011). However, certain researches overlooked the specific misfit between an incumbent's emulation on a discontinuous innovator and the incumbent's value network as well as its impact on emulative strategy. The specific misfit might well count for a lot because

it gives insight into how incumbent could correct the misfit. Using case studies to illustrate how incumbents deal with the sort of misfit will shed lights on why companies failed to respond and how to make it correct.

The first type of misfit is typical and exists between the emulation on disruptor and the incumbent company itself. After Blackboard acquired two Moodle Partners, it begun to run the acquired companies as its open source sub-division since 2012 (Kolowich, 2012b). However, Blackboard did not keep the independence of the sub-division. In American market, Blackboard was restrained from promoting Moodle even it acquired the largest Moodle Partner in America in the fear of cannibalizing Blackboard LMS business (Feldstein, 2017b). Also, Blackboard intended to sell its extension products including Blackboard Ally, SafeAssign and Collaborate alongside Moodle LMS, which was refused by Moodle HQ (Dent, 2018; Lieberman, 2018). The financial contribution to Blackboard-acquired Moodle Partners to Moodle HQ had been declining while their business were actually expanding (Dent, 2018; Doherty and Ronalds-Hannon, 2018).

The various misfits between the incumbent Blackboard and its acquired Moodle Partners derived from the capability misfit between Blackboard and Moodle LMS. For example, the product development of Moodle was based on its worldwide Moodle Community to enable customers to customize LMS while the in-house product development of Blackboard was to meet customers' use of a readily functionable LMS. Blackboard refrained from promoting Moodle in the American LMS market because of its aversion against the self-cannibalization of its own capabilities to support product missions potentially supportable by Moodle. Also, Moodle's refuse to allow Blackboard's in-house developed features to be sold to Moodle customers was another reflection of the capability misfit between them. Blackboard also misfit to its emulation on Moodle's capability by refraining from paying enough of its earnings back

into Moodle HQ, which would undermine Moodle HQ's financial position as capability supporting its LMS improvement.

The similar reject effect was also observed in the case of Canvas. Blackboard emulated the end-user friendliness of Canvas LMS to launch the Blackboard Ultra LMS (Schaffhauser, 2016). However, existing clients of Blackboard with high demand on feature sophistication rejected Blackboard Ultra for which did not deliver features as complete as its predecessor - Blackboard Learn 9.1(Temple University LMS Selection Committee, 2017; DeShong, Vanderlan and Brannan, 2018). Given the situation, Blackboard Ultra was restrained from to being too distinct from Blackboard Learn 9.1 (Phil Hill, 2016a) and was finally offered to clients with the option of interchanging between Blackboard 9.1 and Blackboard Ultra experience (Blackboard Inc, 2016; Schaffhauser, 2016; Temple University LMS Selection Committee, 2017). Moreover, the cloud-based Blackboard Ultra was against certain existing customers' wishes to host LMS on premise and cannibalized Blackboard Learn business (Hayes, 2016; Straumsheim, 2017), Blackboard thus had to continue its on-premise LMS offer.

In the case of Canvas, the misfit was between incumbent's mainstream market and the immature emulation on bypass capability of disruptor. Blackboard agreed to cannibalize itself and emulate the bypass capabilities of Canvas to serve its mainstream market. Nevertheless, the emulation on the bypass capabilities did not only take time to be built up but also, in Canvas case, entailed the cooperation of the mainstream market of Blackboard to build up. Canvas developed LMS features based on its Cloud-based Software-as-Service model through which Canvas could enrich LMS features as a response to customers. The demand-pulling feature development was the capability bypassing the supply-pushing feature development of Blackboard to fulfil the product mission of an LMS. Blackboard's mainstream market refused to accept Blackboard Ultra for it yet to build up the bypass capability fulfilling the product missions valued by the mainstream market. Additionally, certain customers from the

mainstream market refused to move to cloud-hosting LMS in the fear of losing control or violating privacy which were other missions yet to be fulfilled by the bypass capability of Canvas.

In the case of Desire2Learn, Blackboard emulated Desire2Learn's product development capability to better satisfy its mainstream market. As Blackboard emulated Desire2Learn to focus more on its core LMS product, its previous way of acquiring for new revenue streams and distribution network was abandoned and the acquisitions after 2012 only brought in innovations but not income (O'Neil, 2014; Overly, 2014). Combined with the doubled investment into Blackboard LMS and privatization off public financing (Buchanan, 2012; Young, 2013), Blackboard was consequently more indebted, downgraded for financial credibility by Moody and forced to consider selling its payment processing division (Hill, 2015b, 2018b; Doherty and Ronalds-Hannon, 2018). Also, as previous acquisitions were deviated from LMS, new acquisition including campus administration, campus transaction and campus website had to be made to enhance the competitive advantages of those non-LMS products (Wehr, 2003), which again averaged out its commitment between its LMS and Non-LMS products.

In this case, both the incumbent Blackboard and its mainstream market were fitting to the emulation on disruptor's capability, the misfit lied in the investors who was previously fitting to the rapid growth and high revenue resulted from the market penetration strategy of Blackboard. Blackboard did emulate Desire2Learn by investing into both external and internal innovations to better off the performance of its LMS (Buchanan, 2012; Overly, 2014; Straumsheim, 2014a; Bolkan, 2015). However, the emulation on Desire2Learn's product development capability was not fitting well to the Blackboard's previous investors who liked the rapid growth and high revenue from fuelling the previous market penetration of Blackboard. Given the misfit, the refocused financial commitment to blackboard LMS was still distracted

by the investment into the non-LMS products with more rapid growth and higher revenue as before (Wehr, 2003; Overly, 2014).

Conversely, Moodle, Canvas and Desire2Learn rarely emulated exogenous operations/markets to change their organic operations/markets. Their capabilities fit well with their internal operation, external market and investors to reinforce the performance of their unique product benefits. In contrast, Blackboard actively emulated exogenous capabilities mis-fitting with its endogenous internal operation, external market and investors. The misfit undermined the performance of Blackboard's emulative products and hence the continuing disruption from those based on better fit (Serge A. Rijsdijk, Langerak and Jan Hultink, 2011; Technology Evaluation Subcommittee, 2016; Jamieson, 2017b, 2017d; Temple University LMS Selection Committee, 2017; Dent, 2018; Lieberman, 2018).

When the emulative capabilities were evidently mis-fitting to Blackboard itself and its stakeholders, Blackboard overshot its emulative efforts on the bypass capabilities of disruptors. Consequently, the disruptors based on the fit between its bypass capabilities and other stakeholders would continue to disrupt the incumbent company adopting emulation strategy. In 2018，Blackboard terminated its Moodle Partnership with Moodle HQ due to the misfit between them, another Moodle Partner under Moodle HQ immediately received calls from the customers of Blackboard-acquired MoodleRooms, interested in switching from MoodleRooms partially for which was no longer directly supported by Moodle HQ and partially for certain MoodleRooms customers thought more of their paid money should had gone to Moodle headquarter instead of MoodleRooms (Lieberman, 2018)

As a literal repetition of the misfit overshooting, Canvas continued to disrupt the Blackboard's emulation on Canvas based on its better fit with customers. In spite of the announcement of Blackboard Ultra in 2014, Blackboard Ultra was delayed to be available until 2016 due to

further development because earlier adopters prefer a more similar interface between Blackboard 9.1 and Ultra (Blackboard Inc, 2016; Phil Hill, 2016a). The delay held Temple University, Mizzou University and Cornell University back to fully pilot Blackboard Ultra against Canvas, which made them migrated from Blackboard to Canvas although they appreciated the enhanced intuitive user-interface of Blackboard Ultra (University of Missouri, 2015; Temple University LMS Selection Committee, 2017; DeShong, Vanderlan and Brannan, 2018).

Desire2Learn also continued the disruption as the consequence of its fit with investors for its product development strategy. Desire2learn's fit revolved around its focus on LMS. D2L raised money through its two rounds of PE/VC financing (Wan, 2014a, 2014c). Desire2learn spent most of its financing to acquire and improve for the personalized learning and analytics capability of LMS. In 2007, Derby University and Bournemouth University in the UK migrated from Blackboard to Desire2Learn LMS largely because of its personalized learning and data analytics (Jamieson, 2017c, 2017a). Southern New Hampshire University migrated from Blackboard to D2L LMS mainly because of its personalized learning capability (Jamieson, 2017b).

To theorize the analyses of this section, the emulation on disruptors who encroach into the mainstream market of incumbent company often works as the antecedent of misfit overshooting. When the emulations on disruptors are evidently mis-fitting to the incumbent company itself, incumbent's mainstream customers, investors and other stakeholders within the value network of incumbent, incumbent overshoot its emulative efforts on the disruptive innovation, which is the situation of misfit overshooting. Consequently, disruptors based on better fit between their internal capabilities and external stakeholders will continue to disrupt the inferior emulative businesses on the disruptors.

According to the evidences of misfit overshooting in Table 13, the misfit between incumbent and disruptor could be in three forms. The first is the misfit between the capabilities of incumbent and disruptor, which has been researched in classic literature (Gilbert, 2005; Henderson, 2006). The second is the misfit between the underdeveloped bypass capability of the disruptive innovation emulated by incumbent company and incumbent's mainstream market. The third misfit is existent between incumbent's financial investors and its emulation on disruptor's product-market growth strategy. Those misfits are both internal and external to incumbent company.

Although misfit may take effect in every mutually reinforced aspects of a company (Porter, 1996), the key specific misfit informs about what emulation strategy is appropriate to overcome misfit overshooting (Rebecca and Kim, 1990; Bettis and Prahalad, 1995; Gilbert, 2005; Gibbons and Henderson, 2012). For the first type of misfit, previous researches have suggested to emulate disruptor in an independent unit so as to avoid the misfit overshooting induced by the misfit between the capabilities serving different markets (Christensen and Raynor, 2003). For the second form of misfit, incumbent may respond by emulating disruptive product in a hybrid product allowing customers to switch between the incumbent product and the emulated disruptive product. The hybrid product will slide incumbent's customers into the habit of using the disruptive product emulated by the incumbent, slow down mainstream customers' migration to rival's disruptive product for the better product mission synergy of the hybrid product, and help incumbent to develop the underdeveloped bypass capability of its emulated disruptive innovation. In the third situation of misfit, emulating a disruptor, no matter in a separate or integrated unit, would be not enough because the disruptor's external stakeholders including financial investors may exert lock-in effects.

## 4.4. Conclusion

From the within-case analysis, the emergent themes are consistent with preconceptions in Figure 2 including compromised performance and nonabsorbable performance as overshooting as well as trade-off-reversing and trade-off-breaking disruptions. As resources are limited, there will be commitment trade-off between different aspects of product innovation. In the case of Blackboard, resources were heavily skewed towards external acquisitions, which was in trade-off with internal innovation. The compromised commitment to internal innovation improves the function and feature of Blackboard at the expenses of other performance metrics including price, reliability, usability and customizability, which overshot certain customers by compromising the performance metrics they need and overshot the mainstream customers of Blackboard by restricting their capacity to absorb their desired performance metrics. The overshooting also left out opportunities for disruptors to make disruptive encroachment by breaking or reversing the trade-offs between those performance metrics of Blackboard LMS.

While within-case analysis confirms some of the preconceptions about overshooting from the perspective of demand, cross-case analysis further reveals the antecedents and consequences of overshooting from the perspective of supply. The mission perceived by the management of incumbent company to be fulfilled by product could be the initial antecedent to give rise to overshooting. As a company leverages its product innovation, development process and business model to support the product mission, the company may compromise and overlook other performance characteristics or missions needed by certain customers and thus give opportunities to disruptors to reprioritize those performance characteristics or missions.

The nature of overshooting may evolve over time. The product mission could later reinforce the product line of a company to the extent of rigidifying the product line. When the product line becomes rigid, it loses extendibility to fulfil the new product missions or meet the market needs reprioritized by disruptors. The product missions not fulfillable or market needs not met

by the rigid product lines will give opportunities to disruptors to leverage their flexible product lines to bypass the rigid product line to fulfil those missions or meet those needs. At this point, the mainstream or high-end customers of incumbent would switch to the product line of disruptor for which can provide product mission synergy and make the product missions focally improved by incumbent more absorbable by the high-end or mainstream customers of incumbent.

Ultimately, the incumbent may recognize the obsoleteness of its product line and take initiative to emulate the product lines of disruptors. However, the misfits between incumbent, incumbent's investors and targeted customers, and incumbent's emulation on disruptor reduces the performances of its emulated disruptive innovation, which again leaves out opportunities to disruptors based on better fit. Three actors within the value network of incumbent are salient to cause misfit which are incumbent itself, incumbent's mainstream customers and investors. To alleviate the misfit, being willing to accept self-cannibalization, making hybrid product combing incumbent and disruptive product experiences, and seeking for the right financing sources will be helpful.

Up to this point, the emergent categories and patterns so far have been triangulated with the preconceptions in Figure 2, within-case analysis and cross-case analysis. However, there is still a gap between the themes emergent from within-case analysis and cross-case analysis due to their different levels of analysis. The themes or categories emergent from cross-case analysis tend to be from supply side while that from within-case analysis are more associated with demand side. In the next chapter, the themes or categories from two levels of analysis will be compared and corroborated with each other to arrive at a more holistic theoretical framework. Also, the theoretical patterns developed from this chapter will be compared and discussed with relevant literatures so as to reach theoretical saturation (Eisenhardt, 1989).

# 5. CHAPTER FIVE: DISCUSSION OF FINDINGS

## 5.1. Introduction

This research revolves around 'overshooting' as the research pivot to understand what the antecedents and consequences of overshooting in the context of disruptive innovation are. The research setup is derived from the belief that overshooting is an important precondition for disruptive innovation (Christensen, 1997; Christensen, 2006b) but which is inadequately investigated to make for controversy over existing theory of disruption (Klenner, Hüsig and Dowling, 2013; King and Baatartogtokh, 2015; Guo *et al.*, 2019). The key outcomes of case analysis will help to refine our understanding of overshooting, its antecedents and consequent disruptive innovation, which are summarized in Table 14.

***Table 14: Antecedent & Consequences of Overshooting throughout Path Dependence Process***

| Path Dependence Process | Meta-routine | Self-reinforcement | Lock-in |
|---|---|---|---|
| Antecedents | Mission Perception | Product-Market Reinforcement | Corrective Emulation |
| Overshooting | Mission Prioritization Overshooting (Compromised Performance as Overshooting) | Market Penetration Overshooting (Nonabsorbable Performance as Overshooting) | Misfit Overshooting (Compromised/Nonabsorbable Performance as Overshooting) |
| Consequences | Mission Reprioritization Disruption (Trade-off-reversing Disruption) | Market Development Disruption (Trade-off-breaking Disruption) | Fit Disruption (Trade-off-reversing/breaking Disruptions) |

The first section of this chapter will set about to discuss the antecedents and consequences of overshooting based on the theocratical patterns in Table 14, the preconceptions and other relevant literatures. Particularly, the relationships between the themes or categories emergent from within-case and cross-case analysis will be discussed with reference to the evidences from LMS industry to achieve further theoretical triangulation at both the demand and supply levels of analysis. The purpose is to show the reasoning process through which the preconceptions are refined and triangulated with the theoretical patterns emergent from the within-case and cross-case analyses of this research to arrive at the theoretical patterns in Table 14. In the

second section, the contribution of the theoretical patterns in Table 14 will be discussed and located in a wider context of literatures.

## 5.2. Discussion of Findings and Theoretical Patterns

### 5.2.1. Antecedent and Consequence of Mission Prioritization Overshooting

According to the preconceptions summarized in Figure 2, the overprovision of unneeded product performance is brought about by the trade-off between the improvement on different performance characteristics of product. This research supports this observation. According to this research, the compromised or overlooked provision of certain needed performance characteristics of product for improving on other performance characteristics not actually or not so much needed by customers are the reasons why the other product performance characteristics are overly provided and hence the category of 'compromised performance as overshooting'. In the case studies, as incumbent Blackboard purposefully improve certain performance metrics of product to fulfil a product mission, they tend to compromise and overlook other performance metrics important for the fulfilment of alternative product missions. The compromised and overlooked are the manifestation of the trade-off with the overprovided performance characteristics of product.

The trade-off matters because its existence argues that improving product performance to the extent more than that needed by customers is incomplete as overshooting. Previous researches tend to consider overshooting as the overprovision of certain product performance characteristics, like functionality, quality or price, not actually needed by customers (Lukas *et al.*, 2013; King and Baatartogtokh, 2015; Guo *et al.*, 2019) or not so much needed by customers due to diminishing utility (Adner, 2002). However, the evidences of this research support that the product performances traded off or compromised by the overprovision of product

performance is the mechanism of overshooting, which is consistent with the preconception in the Figure 2 of this research.

The case of Blackboard evidences the mechanism of overshooting quite well. Over time, Blackboard constantly improved its number of LMS features but compromised alternative performance dimensions including price, customizability, usability and reliability. Those compromised performance dimensions dissatisfied certain universities with intensive demands on those performance dimensions. The universities were not overshot by the myriad number of Blackboard LMS features but by the compromised price, usability or customizability of Blackboard LMS.

However, as summarized by Table 14, the theoretical framework based on case studies displays the construct of compromised performance as overshooting in bracket under the construct of mission prioritization overshooting. As demonstrated by the case study of Blackboard in this research, the product mission identified by Blackboard will be prioritized in management's cognition and the innovations of product, process and business model, which drives companies to constantly compromise or overlook alternative product missions to be reprioritized by the management of disruptive companies including Desire2Learn, Moodle and Canvas. Customers who were overshot by the incumbent product of Blackboard were actually discontent of the compromised or overlooked performance characteristics, like customizability or end-user friendliness, induced for the constantly prioritized performance characteristics of Blackboard – LMS functions and features. Therefore, the case studies show that the compromised performance as overshooting from demand side is actually driven by a more underlying mechanism from supply side - incumbent's taking certain market needs as priorities and hence the proposed construct of mission prioritization overshooting above the compromised performance as overshooting as two levels of analysis in Table 14.

There is an additional situation yet covered by the preconceptions in Figure 2 that the disruptive performance characteristics of product are not only compromised but also overlooked by incumbent companies. The overlook is consistent with prior research that management may fail to perceive the market needs alternative to their targeted market needs (Christensen and Bower, 1995; Tripsas and Gavetti, 2000; Vecchiato, 2017). The overlook complements previous literature that the trade-off between different product characteristics is not only caused by technical incompetence (William J Abernathy and Clark, 1985; Yu and Hang, 2011; Wessel and Christensen, 2012), but also by cognition.

The trade-off caused by cognition or overlook are yet particularly investigated but are evidenced. For example, traditional insulin product was not disrupted by other insulin products of better quality but by a product with more convenient container of insulin for injection (Christensen, 1997). By the same token, a paint company disrupted incumbent company by simply making its paint container more convenient to open and pour (Van Orden, van der Rhee and Schmidt, 2011). For those examples, it is not a difficult technical challenge to make more convenient insulin and paint containers, but incumbents simply overlooked the convenience dimension needed by customers. In this research, incumbent Blackboard also initially overlooked the certain product missions including customizable LMS and end-user-friendly LMS, which gave opportunity to disruptors to reprioritize the overlooked the dimensions of product performances (Vecchiato, 2017).

The case data of this research also evidences about the kind of cognitive trade-off. Blackboard prioritized online learning management as the most important product mission but overlooked personalised learning as increasingly important product mission for LMS. In this case, it was not so much a technical challenge to integrate its legacy LMS with artificial intelligence to enable personalised learning capability. Desire2Learn successfully transformed from prioritizing putting learning management online to making learning personalised. By contrast,

Blackboard followed the routine rigidity of stressing online learning management features while overlooked the trend that the product concept of LMS had already been shifting to include personalised learning and hence the saying by Jay Bhatt – Former CEO of Blackboard, Inc. that " *somewhere along the line, Blackboard felt like they invented the LMS, and they stopped innovating the actual system*" (Hensley-Clancy, 2015).

The cognitive trade-off reflected by case studies makes for another inconsistency with the preconceptions in Figure 2. Preconception indicates that one of the consequent disruptions is trade-off-reversing disruption. However, as the trade-off could only be existent at cognitive level, the cognitive trade-off can be non-existent in reality. Disruptors may have no need to reverse the trade-off because reprioritizing certain performance dimensions are not in tangible trade-off with the overshooting dimensions for disruptors. For example, the disruptive Desire2Learn LMS improved the personalised learning capability of LMS did not necessarily reverse trade-off by compromising the number of LMS features because the trade-off between personalised learning and LMS features are existent more in the cognition of incumbents than in reality. In other words, when the trade-off is realistically existent, trade-off-reversing disruption is a forced option as disruptors reprioritize the compromised dimension of performance. Conversely, reprioritizing the overlooked performance dimensions do not entail the compromise on the overshooting performance dimensions for overlook is cognitive not realistic. Given the anomaly against trade-off-reversing disruption, the construct of mission reprioritization disruption is displayed above the trade-off-reversing disruption in bracket in Table 14 to reflect the more intrinsic mechanism of the disruptions consequent to overshooting.

In addition to the refined understanding of the compromised performance as overshooting and its subsequent disruption, the case studies in this research also highlights product mission as important antecedent of overshooting. While previous research has already identified market-oriented factors including mainstream customers with more explicit, intensive demand and

higher willingness to pay as the antecedents of overshooting certain performance characteristics of incumbent product (Christensen and Bower, 1995; Adner, 2002; Narver, Slater and MacLachlan, 2004; Bohlmann *et al.*, 2013), the case studies of this research suggest that the mission intended to be fulfilled by the product of incumbent company could be an important determinant of an organisation's overshooting on customers. Mission is considered as effective technique to capture the market opportunities initially by Ansoff (1957) and lately by Christensen (Christensen and Raynor, 2003). Companies tend to emphasize performance metrics in line with the missions fulfillable by its targeted customers. As a consequence, performance characteristics supporting other missions will be largely compromised or overlooked, which might well lead to overshooting (Vecchiato, 2017).

More importantly, product mission does not only add to the existing range of market-oriented antecedents of overshooting but also contributes to account for the encroachment patterns of disruptive innovation. In previous researches, disruptive innovations are traditionally classified into two categories (Christensen, 2006b; Christensen *et al.*, 2018). The first category is low-end disruption The oversupplied performance make the utility return to customers diminishing, which reduces the willingness to pay of customers (Adner, 2002). The oversupplied performance thus gives opportunity to disruptors able to offer product to encroach from the low-end into the mainstream market of incumbents. Another category of disruption is new-market disruption. As market demand is heterogeneous (Adner and Snow, 2010), incumbent companies are more inclined to satisfy their mainstream customers as priority. The new markets are the ones compromised or overlooked by incumbents. In that circumstances, disruptors could simply find new performance areas detached from the core performance characteristics of incumbent to set foothold and make encroachment from there.

However, later researchers find evidences that there are disruptive encroachments from the fringe markets of incumbents (Schmidt and Druehl, 2008b; Van Orden, van der Rhee and

Schmidt, 2011; Rhee, Schmidt and Van Orden, 2012). Fringe market and new market are different from each other that the customers preferences of the two markets as comparison with the mainstream market of incumbents are incremental and radical (Schmidt and Druehl, 2008b). The incremental difference does not warrant a market for a new product category but normally creates a market for a new mission fulfillable by existing product category. For example, Blackboard and Moodle LMS did not differ as much in terms of LMS capabilities. However, Moodle was more capable than Blackboard for its customizability, which did not only enable Moodle to set foothold in the low-end market of Blackboard but also encroach into the fringe market of Blackboard with extra demand on LMS customizability due to the forced migration by Blackboard to terminate its acquired LMS (Justin, 2015c).

Prior research also provides evidences to further triangulate with the case data of this research. For example, the fringe the video game - Wii has less power and fewer features than Xbox but more fun and easier to play for customers unaccustomed to those very sophisticated games (Van Orden, van der Rhee and Schmidt, 2011). In that case, the video game market is expanded by a new mission – play a simple but funny game. As the new mission can be delivered within the old product category of video game, the new gamers in the need of the new mission does not differ radically from traditional gamers in terms of their needs. Moreover, the disruption from Cell phone to land line is a another example from prior research to support the construct of fringe-market disruption (Schmidt and Druehl, 2008b).

New-mission disruptive innovation may thus encroach from fringe market of incumbent companies as another category of disruption. As pointed put by Ansoff (1985), a mission can be a subset of a market and the customers inside a market may have different missions. The low-end disruptive innovation does not change the mission of incumbent product but is only offered at lower price. The new-market disruptive innovation is initially offered to customers with radically different needs from mainstream customers and the needs are so different that a

new product category is created for the needs. The new-mission disruptive innovation is different from low-end and new-market disruptive innovations that it incorporates new mission appealing to new or existing customer but it does not entail radical innovations to create a new product category. Therefore, new-mission disruptive innovation may lead to fringe-market disruption as a new category of disruption apart from the classic dichotomy of low-end and new-market disruptions (Christensen, Raynor and McDonald, 2015).

The Canvas LMS case of this research also support the existence of new-mission disruptive innovation as fringe-market disruption. Canvas LMS was still in the product category of LMS but it was created to accommodate the new missions as end-user-friendly LMS. Apart from the new mission, the customer needs served by Canvas was not radically differently from that served by Blackboard. However, as there are trade-offs between the new missions and the mission prioritized by Blackboard LMS, Canvas thus initially set their footholds in the fringe markets in the need of user friendliness by reprioritizing the LMS usability. Therefore, as a consequence to the mission prioritization overshooting, the fringe-market disruption is reconstructed as 'mission reprioritization disruption' in the theoretical framework of Table 14 because fringe-market disruption is underlyingly enabled by the reprioritization of new mission relative to the prioritized old mission of incumbent product.

In spite of the differences among low-end, fringe-market and new-market disruptions, their underlying mechanisms could be similar. The three types of disruptions share in common that incumbents tend to prioritize the needs from their mainstream markets while overlook or compromise the needs from the low-end market, fringe market and new market. Consequently, disruptors from the low-end, fringe-market and new-market reverse the trade-off between the performance characteristics appealing to the peripheral markets (low-end, fringe and new markets) and the mainstream market of incumbent. As evidenced in case data, initial Moodle or Canvas customers felt reversal of the trade-off between the LMS customizability or usability

and LMS features and hence their switching from Blackboard to Moodle or Canvas. Therefore, trade-off-reversing disruption is actually the demand level outcome of disruptors' reprioritization of product mission or other performance characteristics alternative to that focally improved by incumbent at supply level.

This observation is also consistent with prior research regarding technology convergence (Han, Chung and Sohn, 2009). Table 14 also helps to understand the overshooting and disruption based on technology convergence. Certain disruptive innovations, like camera phone, are convergence of two or more previously independent product categories – digital camera and mobile phone. When digital camera and mobile phone converged into camera phone, the converged product reprioritized the market needs previously compromised or overlooked by the companies making digital camera. Conversely, digital camera companies kept prioritizing the needs from photographers, which overshot (overlook or compromise) their low-end customers who did not want to sacrifice the convenience of camera phone for the overprovided (unneeded or diminishing) utility of digital camera. Finally, digital camera was disrupted from its low-end market by camera phone (Han, Chung and Sohn, 2009)

To summarize, overprovided performance and compromised/overlooked performance could be two compulsory sides of mission prioritization overshooting. Inside incumbent companies, resources are allocated or prioritized for certain product missions or performance characteristics (Christensen and Bower, 1995). As cognition is bounded and resources allocation is prioritized, trade-offs may exist to oversupply certain performance characteristics on one side while compromise others on another side. When the compromised and overlooked performance characteristics or product missions are not worthy of the diminishing or unneeded improvement on the product performance characteristics or product missions prioritized by incumbents for certain customers, mission prioritization overshooting happens. Consequently,

disruptors will reprioritize the overlooked or compromised product missions or performance characteristics of product to encroach into the overlooked or compromised market niches.

### 5.2.2 Antecedent and Consequence of Market Penetration Overshooting

Up to this point, the overshot customers only exists in the peripheral markets (low-end market, fringe market and new market) of incumbents and they are on longer overshot if disruptors come to reprioritize their needs. However, if those disruptors stop there and focus on serving the reprioritized needs, they probably would be confined to their market niches. Nevertheless, certain disruptors not content of staying where they are would continue to disrupt into the mainstream market of incumbent. The continued disruption entails the improvement on the performance characteristics or missions of disruptive product appealing to the mainstream market of incumbent (Wessel and Christensen, 2012). The improvement brings up the construct of nonabsorbable performance as overshooting.

The nonabsorbable performance is one of the decomposed dimensions of overshooting as presented in Table 2. Nonabsorbable performance as overshooting is defined as the situation when traded off or compromised provision of performance characteristics makes the improved performance characteristics needed by customers difficult to be absorbed or hard to be turned into meaningful utility. A typical situation is when the ease-of-use of a product is compromised or traded-off by the constant adding to the number of features and functions of a product, which, in return, causes the fatigue of users to absorb or utilize the added features and functions (Thompson, Hamilton and Rust, 2005).

In the case studies of this research, the compromised and overlooked performance dimensions, like inadequate customizability and poor end-user friendliness of Blackboard LMS, were not only displeasing the customers from the market niches initially occupied by Moodle and Canvas LMS but also later refrained certain traditional institutions of Blackboard from better

absorbing the abundant features and functions of Blackboard LMS. For example, certain medium-to-large institutions targeted by Blackboard considered the features of Blackboard LMS as not adaptable to institution-specific needs and difficult to use even those features were more abundant than competitors (Marksbury, Zhang and Post, 2009; UITS Learning Technologies Functional Requirements Committee, 2013; DeShong, Vanderlan and Brannan, 2018; McKenzie, 2018; Moody, 2018). When the customers of incumbent are refrained from absorbing the product performances they need by other compromised or overlooked performance characteristics, those customers are adversely affected by the nonabsorbable performance as overshooting.

However, by seeing through the supply level analysis from cross-case study, the nonabsorbable performance as overshooting can be organisationally driven by the mutual reinforcement between the mainstream market needs and the product lines of incumbents. Positive market feedbacks including higher profit margins, larger market size and better-defined market are generated through satisfying the mainstream customer needs of incumbent companies (Burgelman, 1991; Christensen and Bower, 1995; Burgelman and Grove, 1996). In return, the positive market feedbacks constantly reinforce a restricted scope of the performance and physical characteristics of product. As the mutual reinforcement between the restricted scope of performance and physical characteristics of product and incumbents' customer needs are ongoing, incumbents will keep moulding its product lines in a way compromising certain product performance characteristics not so needed by their mainstream customers. The compromised or overlooked performance dimensions of incumbent product line will then adversely affect the absorptive capacity of incumbent's customers as overshooting.

In the case data presented in the Table 12 of this research, the nonabsorbable performances supported by incumbent product lines are engendered by the self-reinforcement between Blackboard product line and market needs. For example, the development of Blackboard LMS

for IT administrators and by proprietary R&D team were reinforced with customers' needs on more feature-complete LMS, which constantly compromised or traded off the Blackboard's product development for teachers and students as end-users and by open-sourced R&D team. When the end-user friendliness and open-source customizability were compromised to the extent of adversely affecting mainstream customers' capacity of absorbing the abundant features of incumbent product, compromised performance as overshooting happens. Therefore, product-market reinforcement is antecedent of the compromised performance as overshooting. As the self-reinforcement drives existing product lines to satisfy existing market needs better and better, the self-reinforcement is in nature the persistent execution of market penetration strategy (Ansoff, 1957). The compromised performance as overshooting is thus displayed below the construct of market penetration overshooting in Table 14 to reflect the more underlying nature of the compromised performance as overshooting.

The consequent disruption of market penetration overshooting or nonabsorbable performance as overshooting is trade-off-breaking disruption. To break the trade-off between the prioritized product performance dimensions and the overlooked/compromised performance dimensions of incumbent product helps to remove the refrains on the absorptive capacity of the mainstream customers of incumbents. Once the trade-off is broken, the previously compromise or overlooked performance dimensions will be improved to aid the capacity of incumbent's mainstream customers to better absorb their desired performance characteristics of product. In the case studies summarized by Table 11, Moodle or Canvas LMS broke the trade-off between the number of LMS features and LMS Customizability or LMS end-user friendliness, so they consequently disrupted into the mainstream market of Blackboard by making those LMS features customizable and friendly to use. The cases support the preconception of trade-off-breaking disruption in Figure 2.

Prior researches have paid attention to the sort of trade-off-breaking process, which is considered as the compulsory under which the disruptors encroach into incumbents' mainstream markets (Wessel and Christensen, 2012; Christensen *et al.*, 2018). One notable contribution is that disruptors must have the 'extendable core' to successfully invade from market niches into the mainstream markets of incumbents (Wessel and Christensen, 2012). The extendable core is in nature the capabilities to break trade-off between the performance metrics of products serving incumbent's mainstream markets and disruptors' niches, like the price-quality trade-off between economic hotel and luxurious hotel. However, researches so far haven't yet specified the nature and influence of the extendable core (Christensen *et al.*, 2018 p.1067). The nature and influence of the extendable core or the means through which the break-off can be broken is the key to enable full disruption (Christensen, 2006a; Markides, 2006a).

By viewing via the theoretical lens of 'self-reinforcement', the trade-off-breaking process is essentially a market development process in which disruptors adapts its product line to break the self-reinforcement between market needs and product lines. According to the data of this research in Table 12, the nature of the product line adaption and extension is the 'bypass capability' of disruptive innovation which is the product capability bypassing incumbents' product line reinforced with the missions or market needs favoured by the mainstream markets of incumbents. The reason to bypass incumbent's product line is because which has been reinforced and then rigidified with the mainstream market needs of incumbents to become inadaptable to needs from the markets peripheral to mainstream market. The bypass capability makes disruptor's product line adaptable to the market needs or missions required by both mainstream market and peripheral market customers. For example, the bypass capability of Moodle was the developers from open source community which bypassed the proprietary developers of Blackboard as rigidified product line to satisfy needs of Blackboard's mainstream customers on LMS features.

Another important discovery of this research is that the bypass capability does not only bypass the reinforced product lines of incumbents but is also adapted from the part of disruptive product lines corresponding to the reprioritized market needs or missions by disruptors to support the market needs or missions prioritized by incumbents. The discovery is also consistent with the data in Table 12, the developers from Moodle Community and Moodle Partners as the bypass capability of Moodle LMS did not only bypass the proprietary developers of Blackboard LMS but were also in themselves initially developed for the open source model of Moodle corresponding to its reprioritized market need or mission – customizability to serve the prioritized need or mission of Blackboard – fully featured LMS.

From the perspective of disruptors, disruptors go first to build up product lines to reprioritize the overlooked or compromised market needs by incumbents but later adapt the product lines to meet the prioritized market needs or missions by incumbent. According to the data of Table 7, Canvas LMS was initially built for teachers and students but was later adapted to the needs and missions of IT and administrators for whom were the Blackboard LMS prioritized. Essentially, disruptors adapt their existing product lines for the market needs or missions that the product lines are not purposefully built up for, which is consistent with the construct of market development (Ansoff, 1957). Therefore, 'market development disruption' is constructed in this research to explain the disruption consequent to market penetration overshooting at the supply level of analysis in Table 14.

The market development disruption is a construct more underlying than trade-off-breaking disruption consequent to market penetration overshooting for it uncovers how the trade-off is broken and why the two performance dimensions used to be in trade-off later become in synergy with each other. As discussed in the last two paragraphs, the adaptation of disruptive product lines for the needs and missions from incumbents' mainstream market is the key to break the trade-off. A theoretical repetition from the case data in Table 12 may support that

argument. Desire2Learn LMS was initially in trade-off with the market needs or missions reprioritized by Moodle and Canvas LMS. However, Desire2Learn was not later disrupted by Moodle and Canvas LMS as much as Blackboard into its mainstream market. The reason for it was largely because Desire2Learn has not committed market penetration overshooting by bundling its product lines with the needs or missions of its initial mainstream market for LMS features but instead adapted its product lines for the new market needs or missions of personalized learning. That case theoretically but not literally supports the theoretical proposition in Table 12 that market development disruption is not consequent to those who do not commit market penetration overshooting.

In summary, there is another form of overshooting which is nonabsorbable performance as overshooting. The nonabsorbable performance is different from compromised performance as overshooting that it is mainly the compromised or overlooked performance dimensions of incumbent product adversely affect the capacity of the mainstream market of incumbent to absorb the persistently improved or prioritized performance dimensions of incumbent product. While the case studies of this research support the existence of nonabsorbable performance as overshooting at demand level of analysis, the cases further reveal that the self-reinforcement between market needs and product lines is the underlying reason that certain performance dimensions of incumbents are constantly compromised or overlooked. Disruptors who initially reprioritize the market needs compromised or overlooked by incumbents will later adapt their product lines to the prioritized market needs of incumbent to disrupt into the mainstream market of incumbents. The key for the adaptability of disruptors' product lines is the bypass capability of disruptive product line. Therefore, market development disruption is revealing and corroborating from supply level of analysis about how and why disruptors are able break the performance trade-off held by incumbent and make the performance dimension focally improved by incumbent more absorbable in disruptive innovation.

### 5.2.3 Antecedent and Consequence of Misfit Overshooting

As disruptors encroach into the mainstream market of incumbent, the incumbent should have realized its overshooting and take initiative to break away from it. One common way to unlock incumbent from overshooting, as suggested by Christensen (1997), is to set up an automatous unit to commercialize disruptive innovation. As the automatous unit is not obsessed with incumbent's mainstream customers, profit margin and resource allocation pattern (Henderson *et al.*, 1990; Christensen, Anthony and Roth, 2004), the automatous unit will stand higher chance of successfully capitalizing on disruptive innovations than incumbent itself. Moreover, the independent unit could have the chance to build up its own value network, which further free it from the lock-in effect of the value network of old technology or business model (Rosenbloom and Christensen, 1994; Rothaermel, 2001).

Nevertheless, the need to set up a separate unit is widely challenged. For certain disruptive innovations not in serious conflicts with the business model incumbents, incumbents could just incubate those disruptive innovations within incumbent organisations and pivot on its overshooting performance dimensions product combine with disruptive performance dimensions without radically disrupting the current organisational structure of incumbent (Markides and Charitou, 2004; Markides, 2006b; Raffaelli, 2018). Even disruptive competences is in conflicts with incumbent competences (Anderson and Tushman, 1986), incumbents may still be able to make the two conflicting technologies or business models co-existent inside one company by using ambidextrous capabilities (Tushman and A. O'Reilly III, 1997). Also, the management's rightful attitude to take disruption as opportunity rather than threat can be helpful in making the emulation on disruptor a success (Gilbert, 2005).

As long as the core performance characteristics of disruptive product can be successfully commercialized within incumbent company, the persistent improvement on certain performance characteristics of incumbent product will not compromise the reprioritized

performance characteristics of disruptive product. If without the compromise, overshooting loses its compulsory conditions to exist. Given the likely successful commercialization of disruptive innovation within incumbent company, the case studies of this research also provide as natural experiments to see what might hold incumbent back to make the commercialization a success. The holdbacks take effects as the mechanism of 'lock-in' to refrain incumbent from successfully commercializing disruptive innovation.

As disruptors encroach into the mainstream market of incumbents, incumbents should have been aware of the market needs and relevant customer-facing competences that they failed to put in the right perspective before (Henderson, 2006; Vecchiato, 2017). In spite of the awareness, the case studies of this research tell that incumbent may still be held back to emulate or commercialize disruptive innovations and keep overshooting certain performance characteristics. It is thus appropriate to see through the theoretical lens of lock-in mechanism to ascertain those holdbacks. As discussed in the chapter of literature review, the mechanism of lock-in indicates a hardly escapable pattern of organisational behaviours even the organisations are consciously intent on escaping off. Therefore, case studies inform about what are the lock-in factors make incumbent inescapable from overshooting even incumbent is fully aware of its overshooting and take conscious actions to escape by emulating disruptive innovation.

According to the date in Table 13, Blackboard as incumbent rejected the idea of setting up an independent unit from incumbent but emulate disruptive innovation within incumbent company itself. As predicted by prior theories, the commercialization on disruptors can be held back by incumbent itself if which does not take the emulation on disruptive innovation as opportunity but as threat (Gilbert, 2005). The emulation on Moodle was unsuccessful because the less profitable open source model of Moodle threated and cannibalized the more profitable model of Blackboard, which is also consistent with prior discovery that the higher profit margin

may hold incumbent back to invest the lowly profitable disruptive innovation (Christensen and Raynor, 2003). However, the contradictory evidences were that Blackboard's emulations on Canvas and Desire2Learn were still held back even Blackboard emulated on the two disruptors without much reservation. According to the data in Table 13, the holdbacks came from the value network or ecosystem of incumbent product – the mainstream customers and investors of incumbent.

By comparing across the cases in Table 13. Those misfits between incumbent itself and its emulation on disruptor are more salient between Blackboard and Moodle. For Canvas and Desire2Learn, the misfits rested more with the interfaces between incumbent's emulations on disruptive innovation and other actors from the value network of incumbent other than incumbent itself. The reason may be because the newly inaugural CEO – Jay Bhatt at that time embraced the emulations on Canvas and Desire2Learn more fully than the emulation on Moodle and positioned the acquired Moodle product to serve its low-end and overseas market (Kolowich, 2012b; Flook, 2013b, 2013a; Hensley-Clancy, 2014; Hill, 2014; Cohn, 2018). More importantly, Blackboard did not fully embrace Moodle by incorporating the most disruptive characteristics of Moodle – open source into its proprietary Blackboard LMS due to the higher profit margin of proprietary software. The observation is consistent with prior evidence that the hesitation of incumbent to fully commercialize disruptive innovation in the place of obsolete incumbent product could be because of higher profit margin associated with the obsolete incumbent product (Christensen and Raynor, 2003). Moreover, the hesitant emulation on Moodle implies that the change of top management may alleviate the problem of dominant logic or other embedded competences engendering overshooting except for the problem of profit margin.

Although incorporating the most disruptive performance characteristics into incumbent product made the emulation on disruptive Canvas LMS – Blackboard Ultra less subject to the

misfits with incumbent itself, the misfits shifted to lie more in the interface between the emulated disruptive innovation and incumbent's mainstream customer. According to the data displayed in Table 13, Blackboard initially created a more Canvas-like LMS named as Blackboard Ultra and the Ultra version was fully supported inside Blackboard without the hesitation in the support to the emulation on Moodle. However, the mainstream customers of Blackboard dissatisfied with the initial version of Blackboard Ultra for it yet to offer functions and features as complete as the legacy Blackboard LMS. The dissatisfied mainstream customers forced Blackboard to attenuate its full embrace of Canvas LMS and recreated a hybrid product with the option of interchanging between the legacy Blackboard LMS and the more Canvas-like Blackboard Ultra version. By resolving the misfit with mainstream customers, Blackboard later regained welcome from mainstream customers.

The case sheds some new lights on how can incumbent cope with the lock-in from its mainstream customers so as to avoid overshooting. In line with prior discovery, hybrid can be a feasible alternative to an autonomous unit to contract disruptive innovation (Furr and Snow, 2015). However, as many hybrid innovations are still doomed in front of disruptive innovation (Suarez *et al.*, 2018), evidence from this research specifies certain conditions under which hybrid might well be a successful counteraction over disruption. In the case of Blackboard's emulation on Canvas, the hybrid product made by Blackboard helped it to build up the performance characteristics of the emulated Canvas LMS appealing to the mainstream customers of Blackboard. In other words, if a hybrid product could help incumbent to build up the bypass capability of its emulated disruptive innovation, it would be a more rational alternative than to give up legacy incumbent product for disruptive innovations with inadequate bypass capability to dissatisfy incumbent's mainstream customers.

Preconceptions in literature review specified at micro-level about the market-oriented and organisation-centred factors confining incumbent to overshoot the obsolete performance

dimensions of incumbent product. However, by seeing through the theoretical lens of lock-in mechanism in Figure 2 and zooming out at macro level to exam the overall value networks of incumbent and disruptive products, the misfits between the emulation on disruptive innovation and incumbent itself or its other value network are the underlying reasons why incumbent's still unable to escape overshooting certain obsolete performance characteristics of incumbent product. Therefore, the unescapable overshooting induced by internal and external misfits in spite of incumbent's initiative to escape by emulating disruptive innovation is constructed as 'misfit overshooting' in the theoretical propositions in Table 13.

Counterintuitively, the corrective emulation on disruptive innovation is considered by this research as one of the antecedents of overshooting certain performance characteristics of incumbent in Table 13. Preconceptions in literature review support the full embrace of or pure emulation on disruptive innovation to avoid overshooting certain obsolete performance characteristics of product (Gilbert, 2005). Conversely, the case from Blackboard's emulation on Canvas LMS does not support a pure emulation on disruptive innovation but a partial emulation as a hybrid product. The dilemma is because that different mode of corrective emulation on disruptive innovation may misfit with different actors within incumbent's value network, incumbent needs to consider each mode of corrective emulation and their misfits with different actors. For example, incumbent Blackboard emulated the disruptive Moodle LMS inadequately by not incorporating open source into its Blackboard LMS to cause misfit with Blackboard itself. By contrast, incumbent emulated the disruptive Canvas LMS overly by not incorporating legacy Blackboard LMS into Blackboard Ultra to cause misfit with Blackboard's mainstream customers. No matter whatever is the misfit, the specific mode of corrective emulation on disruptive innovation is leading to the specific misfit engendering overshooting and hence the construct of corrective emulation as the antecedent of misfit overshooting in Table 13.

The ‘corrective emulation – misfit overshooting’ relationship is also confirmed by Blackboard’s emulation on Desire2Learn. According to the date from Table 13, Blackboard emulated Desire2Learn by acquiring products to strengthen its core Blackboard LMS. As those acquired products were no longer rival LMS acquired to eliminate rivals and gain market shares as before, the emulation on Desire2Learn’s acquiring to strengthen core LMS led to misfit with Blackboard’s investors who was previously supportive of Blackboard’s acquiring for rival elimination and customer acquisition. Blackboard’s emulation on Desire2Learn added to the product missions of its LMS but did not bring in as many acquired customers as before, which conflicted with Blackboard’s investors who expected the revenue returns from Blackboard’s previous acquisition of new customers. The misfit manifested as Blackboard’s financial constraints and default risks which refrained Blackboard from dedicating more to its emulation on Desire2Learn LMS and hence more misfit overshooting.

From the analysis level of supply, misfit overshooting is different from mission prioritization overshooting and market penetration overshooting that the underlying organizational mechanism is lock-in but not meta-routine or self-reinforcement. From the supply level of analysis, the market mechanism of misfit overshooting is compromised or nonabsorbable performance as overshooting hence which is displayed in brackets under the construct of misfit overshooting in Table 13. However, unlike mission prioritization overshooting and market penetration overshooting, customers are not overshot by incumbent’s legacy product but by incumbent’s emulation on disruptive innovation.

In other words, the emulation on disruptive innovation has already alleviated compromised or nonabsorbable performance as overshooting for the emulated disruptive innovations are in themselves trade-off-reversing or trade-off-breaking. However, as of the misfits internal and external to incumbent, the trade-off is not so well reversed or broken by the emulation on disruptive innovations as the disruptive innovations themselves, which makes for disruptions

based on better fit. As the disruptive innovation based on better fit enables the disruptive innovation to be more trade-off-reversing or trade-off-breaking, the trade-off-reversing/trade-off-breaking disruptions are displayed in brackets under the construct of fit disruption in Table 13 to emphasize the more underlying mechanism of fit disruption.

Case data from Table 13 illustrates the disruptions based on the better fit between disruptors and their value network. The misfits between Blackboard's emulation on disruptive innovation and Blackboard itself as well as Blackboard's investors and mainstream customers acted as frictions rendering the emulations on disruptive innovations including Moodle, Canvas and Desire2Learn LMS either delayed or not so genuine and competitive as the disruptive innovations themselves. On the contrary, disruptive innovations including Moodle, Canvas and Desire2learn continued to disrupt Blackboard's emulated disruptive innovation based on the better fit internal to disruptors and external to their disruptive value network.

Although the specific misfit interface causes either compromised performance or nonabsorbable performance as overshooting, overshooting itself actually happens as a consequence of incumbents' initiative to emulate disruptor and commercialize disruptive innovation by themselves. According to the case data regarding the emulation on Moodle in Table 13, the cannibalization of Moodle on the higher profit margin of Blackboard LMS threated the management of Blackboard, Inc. and drove the management to emulate Moodle with much hesitation. The hesitation did not only stop the acquired Moodle version from encroaching into the mainstream market of Blackboard but also prevented the performance characteristics of acquired Moodle version from being brought into full play and hence misfit overshooting. Therefore, corrective emulation is considered as the antecedent of misfit overshooting.

The case of canvas also supports corrective emulation as the antecedent of misfit overshooting. According to the case data of Canvas, incumbent Blackboard emulated Canvas without hesitation or the fear of being cannibalized. Still, the emulation on Canvas failed initially to perform as genuine and competitive as Canvas itself. The reason was because of the misfits between incumbent and its mainstream customers. Nevertheless, the misfit did not cause the emulation on Canvas to be curtailed in terms of its performances for end-user friendliness but made the fully emulated version inadaptable to serve the mainstream market of Blackboard due to inadequate number of LMS features. As a result, Blackboard had to retreat to a hybrid version keeping some of its legacy LMS features without fully breaking the trade-off between LMS features and usability. In other words, the hybrid version of Blackboard still overshot some of its mainstream customers as nonabsorbable performance for the myriad number of Canvas LMS features could be better absorbed based on better usability at that time.

To sum up, through the mechanism of lock-in, misfits internal and external to incumbents may refrain incumbent from successfully emulating disruptive innovation. The misfits may attenuate or exert lock-in effects on incumbent's emulation on disruptive innovation, which render the emulation on disruptive innovation delayed, underdeveloped, or less genuine in comparison with the disruptive innovation itself and hence misfit overshooting. Conversely, disruptive innovation can be more competitive in terms of breaking or reversing the trade-offs held by incumbent products based on better fit with disruptor itself, investors, mainstream and peripherical markets. Consequently, disruptive innovation will continue to disrupt the emulated disruptive innovation by incumbent based on better fit. As incumbent's decision to make corrective emulation on disruptive innovation leads to the misfits from different stakeholders within the value network of incumbent product and disruptive product, corrective emulation is considered as the antecedent of misfit overshooting.

## 5.3. Discussion in a Wider Context of Literature

The theoretical outcomes of this research are mainly related to three streams of literatures concerned with companies' persistent improvement on certain performance characteristics of product to the extent of overshooting. The first stream of literatures comes from those studying overshooting in the context of its market-oriented impact (Christensen, 1997; Christensen, 1997; Adner, 2002; Adner and Snow, 2010; Wessel and Christensen, 2012; Klenner, Hüsig and Dowling, 2013; King and Baatartogtokh, 2015; Zhang, 2015; Raffaelli, 2018); the second stream takes the perspective of organisational competences which are rigidified to confine companies to overshoot certain performance characteristics of product (William J. Abernathy and Clark, 1985; Goldenberg and Horowitz, 2003; Gilbert, 2005; Kaplan and Henderson, 2005; Henderson, 2006; Sterman *et al.*, 2007; Kaplan and Tripsas, 2008; Yu and Hang, 2011; Lukas *et al.*, 2013; Nagy, Schuessler and Dubinsky, 2016; Vecchiato, 2017); the third stream reaches beyond companies and markets to consider the overall value network of incumbent product and its restrictions on over-shooter's efforts to shrug off overshooting (Rosenbloom and Christensen, 1994; Adner and Kapoor, 2010; Huesig, Timar and Doblinger, 2014; Parry and Kawakami, 2017; Roy and Cohen, 2017).

Overshooting is initially defined as improving certain performance characteristics of product to the extent more than that needed by customers or to extent of making customers hard to absorb improvement even they need it (Christensen, 1997). However, researches after that tend to only consider overshooting as product performance provision more than the actual needs of customers but neglect the situation that customers can be refrained from absorb the provision of product performances (Wessel and Christensen, 2012; Klenner, Hüsig and Dowling, 2013; King and Baatartogtokh, 2015; Raffaelli, 2018). Also, although it is rational for companies provide much more than that actually needed by mass markets for they are incentivized to do so by the higher profit margin of high-end market (Adner and Zemsky, 2006), it is not rational

for customers to reject the definitely more than their needs for the just enough for their needs. Therefore, this research manages to interpret customers' incapacity to absorb certain product performance as overshooting as well as enhance people's understanding of the provision of product performance exceeding that needed by customers as overshooting.

This research clarifies that improving product performance to the level more than that needed by customers is incomplete as overshooting. There is a trade-off between different product performance characteristics of product, so certain performance characteristics of product are improved at the compromise of other performance characteristics of product (Hauser, 2001; Thompson, Hamilton and Rust, 2005; Wessel and Christensen, 2012). When product performance is improved to the level not so much needed by customers, the overprovision of performance unneeded by customers can make the performance characteristics traded off or compromised needed by customers unworthwhile, which is mechanism of the compromised performance as overshooting. Compromised performance is one of the two decomposed dimensions overshooting and is consistent with previous understanding that customers may get diminishing return of utility from increasing improvement on product performance (Adner and Levinthal, 2001; Adner, 2002). However, this research emphasizes that customers are not overshot only because of the diminishing utility but also because of the compromised or traded-off performance characteristics of product. The improvement on the performance characteristics of product may overshoot customers because the diminishing utility of the improvement is not worthy of other performance characteristics very much needed but compromised or traded off.

Another decomposed dimension of overshooting is nonabsorbable performance which is also brought about by the trade-off between different performance characteristics of product. When the traded of or compromised provision of performance characteristics of product makes the improved performance characteristics of product needed by customers difficult to be absorbed

or hard to be turned into meaningful utility, nonabsorbable performance as overshooting happens. This definition is consistent with previous observation that the improvement on the number of product features may compromise or trade off the ease-of-use of product, which makes customers hard to absorb improved number of features (Thompson, Hamilton and Rust, 2005). The two decomposed dimensions of overshooting are considered as the underlying mechanism of the overshot customers described by previous research as those considering product "overengineered, difficult to fully utilize, difficult to understand, or simply not ideal" (Lukas *et al.*, 2013 p.1).

As overshooting is initially brought up as a precondition of disruptive innovation (Christensen, 1997), the decomposed dimensions of overshooting suggested by this research may improve the understanding of the process through which overshooting leads to disruptive innovation. To be specific, compromised performance as overshooting gives opportunity for disruptors to reverse the trade-off by reducing the previously overprovided performance characteristics and improving the performance characteristics previously compromised or traded off, which is named as trade-off-reversing disruption. Nonabsorbable performance as overshooting gives opportunity for disruptors to break the trade-off by improving the previously compromised performance characteristics so that customers have better capacity to absorb the previously improved performance characteristics, which is constructed as trade-off-breaking disruption.

The suggested relationships between the decomposed dimensions of overshooting and disruptive innovation are consistent with previous observations that disruptive innovation normally originate from markets peripheral to the mainstream market of incumbent and later encroach into the mainstream market of incumbent (Christensen, 2006a; Van Orden, van der Rhee and Schmidt, 2011; Rhee, Schmidt and Van Orden, 2012; Bohlmann *et al.*, 2013). Therefore, the suggested relationships will enrich the understanding of why certain disruptive innovations only occupy the markets peripheral to the mainstream market of incumbents while

others are able to disrupt into the mainstream market of incumbent (Markides and Charitou, 2004; Markides, 2006a; Wessel and Christensen, 2012; Christensen *et al.*, 2018)

The refined definition of overshooting helps to explain some of the anomalies unexplainable based on previous definition of overshooting. For example, traditional surgery is somehow disrupted by microscope surgery, the reason is not because the curative effect of traditional surgery is too good for patients but because it trades off or compromises the other performance dimensions like the wound healing after operation (King and Baatartogtokh, 2015). If with this refined definition of overshooting taken into account, the predictability of overshooting as the precondition of disruptive innovation could be improved for certain researches (Sood and Tellis, 2010; Klenner, Hüsig and Dowling, 2013; Guo *et al.*, 2019).

Apart from the market-oriented explanations of overshooting and its consequent disruptions, this research also sees through the perspective of organizational path dependence process to ascertain the antecedents and consequences of overshooting (Driel and Dolfsma, 2009; Sydow, Schreyögg and Koch, 2009). The outcomes are that overshooting can be driven three path dependence mechanisms which are meta-routine, self-reinforcement and lock-in. Correspondingly, there are three forms of overshooting and their respective antecedents and consequent disruptions. By taking the perspective of organization, the three forms of overshooting complements and triangulate with the overshooting defined from the perspective of market to arrive at a more balanced and realistic truth of overshooting and disruption. The theoretical perspective synthesized by organization and market is justifiable by the contention that overshooting and disruption are better to be studied from the angle of the market-facing competences of organization (Henderson, 2006).

The first of the three forms of overshooting is ‘mission prioritization overshooting’ which is caused by the mission perceived by incumbent management to be fulfilled by incumbent

product. This research emphasizes that missions are different from markets that a market may contain many customers while each customer may have many missions to accomplish (Ansoff, 1957). While managerial cognition can be framed according to profit model, innovation approach and dominant design (Tripsas and Gavetti, 2000; Kaplan and Tripsas, 2008; Thrane, Blaabjerg and Møller, 2010), managerial cognition of certain product missions may also act as important cognitive inertia in persistently improving and overshooting certain performance characteristics of product and responding to discontinuous innovations targeted at alternative missions required by market (Vecchiato, 2017).

Mission prioritization overshooting can be followed by mission reprioritization disruption. the priority of certain product missions can be broken and reprioritized as disruptive innovation. The case studies of this research have showed that the prioritized product mission of Blackboard LMS is to realize online learning management while Moodle LMS reprioritized its mission as making LMS highly customizable. The different weights put on the different missions of the same product category adds evidence to previous research that the different elements of product concept can be shifted or frozen according to the varying market environment and technological development to create radical innovation (Seidel, 2007). In the case of Moodle LMS, it froze the mission of online learning management of Blackboard LMS and shifted the mission of customizing LMS to a higher order of importance.

As discussed in the last section, the mission reprioritisation disruption consequent to mission prioritisation overshooting adds as a new category of disruptive innovation. On top of the dichotomy between low-end and new-market disruptions (Christensen, Raynor and McDonald, 2015), the reprioritisation disruption may represent as a new category of disruption – fringe-market disruption. Fringe-market disruption distinguishes itself from low-end and new-market disruptions by encroaching from the fringe markets of incumbent and embodies as product innovation prioritizing the product missions downplayed by incumbent product but staying

within the same product category as incumbent product. Fringe-market disruption is consistent with the other disruptive innovations that it is initially targeted at an emerging market (Govindarajan, Kopalle and Danneels, 2011; Van Orden, van der Rhee and Schmidt, 2011).

Fringe-market disruption also stay in the mid of the spectrum between low-end and new-market disruptions in terms of product category. Low-end disruption is within the same product category of incumbent product except for its lower price while new-market disruption normally presents as a new category of product. That is consistent with prior knowledge that new-market disruption entails the capability of disruptor for opportunity creation while low-end disruption only needs the ability for opportunity discovery (Chieh, Garnsey and Ruan, 2015). Fringe-market disruption stays in the middle by not belonging to a new product category but differentiating itself from low-end disruptive innovation that it incorporates new features or functions supporting new product missions. As a result, fringe-market disruption does not need disruptor to create as much as new-market disruptor for a new product category, nor enough to simply discover an existing opportunity ready to be explored by cheaper existing product without incorporating new features.

The second of the three forms of overshooting is market penetration overshooting which emphasizes the reinforced product lines by certain market needs or missions required by customers. This form of overshooting adds supportive evidence to previous researches that the organisational competence to fulfil certain missions of customers may become organisational rigidity confining incumbent to overshoot certain performance characteristics of product (Christensen and Raynor, 2003; Henderson, 2006; Vecchiato, 2017). Researches have traditionally been concerned with various organisational rigidities confining incumbent to overshooting certain performance dimensions of product (Anderson and Tushman, 1986; Henderson *et al.*, 1990; Barnett and Pontikes, 2008; Serge A Rijsdijk, Langerak and Jan Hultink, 2011; Yu and Hang, 2011; Gibbons and Henderson, 2012). One stream of literatures

argues that certain organisational competences linking to certain market needs can be rigidified as well to confine incumbent to overshoot the performance characteristics of product meeting certain market needs (William J. Abernathy and Clark, 1985; Christensen and Bower, 1995; Henderson, 2006; Vecchiato, 2017). Mission prioritization overshooting is the similar situation in which overshooting happens as a result of the rigidified linkages between product lines and the missions required by customers (Ansoff, 1957; Christensen and Bower, 1995; Henderson, 2006; Vecchiato, 2017). The rigidity is induced by the self-reinforcement between product lines and the missions required by customers or other market needs.

Market penetration overshooting also reveals the organisational mechanism through which the nonabsorbable performance as overshooting is enabled may become salient. As the self-reinforcement between certain product performances and market needs are intensified, the trade-off between the improvement on certain performance characteristics and the compromise on other performance characteristics will be escalated. The increasingly compromised performance characteristics of product will increasingly undermine customers' capacity in absorbing the increasingly improved performance characteristics of product, which makes nonabsorbable performance as overshooting more salient. Therefore, market penetration overshooting complements nonabsorbable performance as overshooting with organisational perspective.

The self-reinforcement between product lines and market needs may rigidify both the physical and performance characteristics of incumbent product. Product line includes the physical characteristics and performance characteristics of product (Ansoff, 1957). Certain physical and performance characteristics of incumbent product will be reinforced reciprocally with certain market needs served by incumbent to become competitive resource but which is also increasingly reinforced as resource rigidity (Leonard‐Barton, 1992). Previous research also

observes that the resource allocation pattern of organisation tend to be shaped or reinforced by the performance characteristics of product explicitly needed by company's mainstream customers (Christensen and Bower, 1995; Lamore, Berkowitz and Farrington, 2013). This research also supports that the organisational practices prioritizing certain performance characteristics of product could be self-reinforced with certain market needs as routine rigidity (Gilbert, 2005). Given the resource and routine rigidities, incumbents are better understood about their difficulties in responding to disruptive innovations.

The self-reinforcement between product lines and market needs also shed lights on how might the nonabsorbable performance as overshooting gives opportunity to trade-off-breaking disruption. Previous researches explain the mechanism as that incumbent persistently improves along certain performance trajectories of product but trades off other performance improvement trajectories, which gives opportunity for disruptors to break the trade-off (Wessel and Christensen, 2012; Christensen *et al.*, 2018). However, breaking trade-off is only the product performances perceived by market, this research clarifies from organisational perspective that the resource and routine rigidities induced by the self-reinforcement between product lines and market needs makes incumbent hard to adapt its product lines to serve needs from both incumbent and disruptor' targeted customers and hence their incapability of breaking the trade-off. By contrast, disruptors are able to break the trade-off by adapting its product lines to serve the needs from both incumbent and disruptor' targeted customers.

In order to make the disruptive product lines adaptable, disruptors have to bypass the resource and routine rigidities associated with incumbent product lines to serve the needs of incumbent's targeted customers. To ensure the bypass, disruptors can adapt from the part of disruptive product lines corresponding to the market needs initially targeted or reprioritized by disruptors to support the market needs targeted by incumbents. As incumbent downplays the market needs initially targeted or reprioritized by disruptors, the part of disruptive product lines supporting

the market needs downplayed by incumbent will bypass the part of incumbent product line reinforced with and rigidified by the market needs targeted and prioritized by incumbents. By the same token, the part of disruptive product lines supporting the market needs downplayed by incumbent will bypass the self-reinforcement pattern of incumbent based on the prioritized performance characteristics of incumbent product as routine rigidity which means the "failure to change the organizational processes that use those resource investments" (Gilbert, 2005 p.741).

The sort of bypass capability defined by this research is consistent with the stream of literatures concerned with how to make disruptive innovation (Yu and Hang, 2011; Wan, Williamson and Yin, 2015; Nagy, Schuessler and Dubinsky, 2016). The stream of literatures is contributed by researchers believing disruptive innovation can be technically made according to their summarized characteristics of disruptive products relative to incumbent products. Despite the differences between their summarized means of making disruptive innovation, those means all share that disruptive products are created through the simultaneous shifts of both the physical and performance characteristics of incumbent product. The simultaneous shifts may later give disruptors the capability to bypass certain physical characteristics of incumbent product as resource rigidity and organisational practices prioritizing certain performance characteristics of product as routine rigidity parallelly induced by the self-reinforcement between the product lines and the mainstream market needs of incumbent.

The third form of overshooting is misfit overshooting which is concerned with the lock-in effects imposed by internal and external fits of incumbent. Previous researches concern with this problem suggest that the complementary assets of incumbent product may refrain incumbent from successfully commercializing disruptive innovation (Tripsas, 1997; Roy and Sarkar, 2016; Parry and Kawakami, 2017), incumbent may need to escape regulations from government to incubate disruptive innovation (Huesig, Timar and Doblinger, 2014), the

downstream customers also influence the success of disruptive innovation commercialization by incumbent (Adner and Kapoor, 2010). This research adds to the stream of literatures by showing evidences that investors, mainstream customers and incumbent product may hinder the successful commercialization of disruptive innovation.

However, the key to solve those misfits depends on the mode of misfit. If the mode of misfit is induced by the hesitated emulation on disruptive innovation in the fear of cannibalizing profit margin, the misfit will lead to trade-off-reversing disruption. In case data, the management of Moodle and investors of Desire2Learn were in the fear that the emulation on Moodle and Desire2Learn would cannibalize the profit margin of Blackboard, which held them back to fully emulate Moodle and Desire2Learn. The holdback refrained the emulated Moodle and Desire2Learn from bringing their reprioritized performance characteristics – cheapness and personalised learning into full play and hence the continuous disruptions from the genuine Moodle and Desire2Learn based on better fit. This finding is consistent with prior theory that incumbent may fail to commercialize disruptive innovation due to inadequate financial incentive and self-cannibalization threats (Gilbert, 2005; Christensen *et al.*, 2018).

Nevertheless, this research provides evidence that incumbents may still fail to commercialize disruptive innovation even which is emulated without hesitation. The emulation on Canvas was the evidence that incumbent still failed to commercialize disruptive innovation even which was fully embraced and emulated. Therefore, this research claims that incumbents who intends to commercialize disruptive innovation do not only need to emulate disruptors without the fear of self-cannibalization but also deliberately control the emulation on disruptors according to the actual needs of mainstream customers. For example, Blackboard later successfully commercialized the disruptive Canvas by offering a transitional hybrid product combing the advantages of both Canvas LMS and its legacy Blackboard LMS. That contention is different

from previous observation that emulating disruptor without any reservation will successfully commercialize disruptive innovation (Gilbert, 2005).

Given the various forms of overshooting and their antecedents, the relevant coping strategies to overshooting can be improved. To be specific, mission prioritization overshooting can be coped through a wider scope of market scanning for the emerging needs or new missions of customers, especially the needs from the markets peripheral to the mainstream market of incumbent. The market scanning is different from pervious market-oriented coping strategies which tend to dodge the attack from disruptive innovation (Adner and Snow, 2010; Christiansen *et al.*, 2010; Wessel and Christensen, 2012). Market penetration overshooting can be dealt with through involving outsiders into the top management team. The coping strategies is given based on the prerequisite that incumbent is impossible to unbundle from the resource and routine rigidities associated with market penetration overshooting. However, if trying to be in line with previous researchers trying to locate the specific rigidity and break away from the rigidity (Gilbert, 2005; Kaplan and Henderson, 2005; Barnett and Pontikes, 2008; Thrane, Blaabjerg and Møller, 2010; Yu and Hang, 2011; Lukas *et al.*, 2013), the coping strategy can be formulated as adapting incumbent product line for emerging needs or new product missions or simply abandon incumbent product for discontinuous technological replacement.

This research also provides insights into the encroachment patterns of disruptive innovation. Disruptive innovations may encroach into the mainstream markets of incumbent company from low-end or new markets (Christensen, 1997), high-end market (Rhee, Schmidt and Van Orden, 2012) and fringe markets (Van Orden, van der Rhee and Schmidt, 2011). However, researches are scarce about those disruptive innovations encroach directly into the mainstream market of incumbent. In this research, Canvas LMS was such a disruptor encroaching directly into the mainstream market of Blackboard LMS. Arguably, Moodle LMS was another example of encroaching into the mainstream market of Blackboard LMS.

By comparing the two companies, one common mechanism shared by the two companies was that they both conducted vertical disintegration towards the value chain of incumbent product. For Canvas, it went around campus administrators or management to interact directly with teachers and students. The same holds up for Moodle, it acted as a platform company to promote the direct interactions between software developers and institutions.

The disintermediation brought about by vertical disintegration seemed as the key for the disruptive innovation encroaching directly into the mainstream market of incumbents. The disintermediation shortens the distance between two links of a value chain, which better adapts products to the needs of customers. Where the cases of Canvas and Moodle are concerned, Canvas became a more tailored product for end-users by disintermediating IT administrators or campus management while Moodle become more tailored to institution-specific needs by disintermediating LMS company itself. Conversely, incumbent companies tended to do the opposite by conducting horizontal integration which means to merge same part of value chain from competitors. For example, Blackboard LMS actively merged with WebCT, Angel and other rival LMS. The outcome was intermediation by putting several different LMS into one-size-fit-all Blackboard LMS, which made Blackboard LMS less tailored for the needs of the acquired customers from rival LMS and forced their migrations off Blackboard.

However, that observation conflicts with prior researches. Prior researches contend that vertical integration is necessary for incumbent firms to improve the performance of product when the architecture of product is yet to be stabilized (Christensen, Verlinden and Westerman, 2002). When product performance overshoots the needs of customers, vertical disintegration or disintermediation would happen to provide better customized, more responsive and cheaper product (Christensen *et al.*, 2018).

Nevertheless, this research observes that it is not the oversupplied performance based on vertical integration triggers the disruptive innovation based on vertical disintegration or vertical disintermediation. Instead, it is the intermediation induced by horizontal integration distorting the direct interaction between two links of a value chain, which gives opportunity to disruptive innovation based on the disintermediation to make product more tailored to the needs of customers. In Blackboard case, the intermediation caused by Blackboard's horizontal merge with rival LMS triggered the disruptions from Moodle and Canvas which created products more tailored to customer needs through vertical disintegration or disintermediation.

This contradictory observation could actually be better interpreted by the case data of this research. The horizontal integration or merge with the same parts of value chain from competitors compromised the adaptability and customizability resulted from the disintegration or disintermediation of value chain. When the adaptability and customizability of product provision are welcomed by mainstream customers, those customers do not sacrifice much from a product based on horizontal integration for the adaptability or customizability of a product based on vertical disintegration. The reason is because disruptors leverage bypass capability to maintain or improve the performance characteristics or product missions previously offered by incumbent product based on horizontal integration. For instances, Canvas offered a better adapted LMS to end-users but it did not compromise its product performance for IT administrators; Moodle used its open community and internal developers and Moodle Partners to ensure the features delivery and reliability needed by the mainstream customers of Blackboard.

Finally, this research adds new evidence to the theory of path dependence process (Schreyogg and Sydow, 2011). The two-decade longitudinal case study of Blackboard Inc. embodies the three underlying mechanisms of path dependence process which are meta-routine as initial condition (Driel and Dolfsma, 2009), self-reinforcement driven by positive feedback (Dobusch

and Schussler, 2012) and Lock-in as rigidity (Schreyogg and Sydow, 2011). Particularly, this research evidences that the meta-routine mechanism may co-exists with the other two mechanisms typical of path dependence process. The perceived product mission by Blackboard founders acted as meta-routine in the initial founding period of Blackboard Inc. to shape the more specific path for the product mission to be fulfilled and the path is through merger and acquisition of rival LMS. Later, the constant integration of Blackboard LMS with rival LMS was driven by the positive feedbacks including expanding market shares, increasing shareholder values, rival eliminations and increasing number of online learning management features. However, all those positive feedbacks in the final analysis escalated the self-reinforcement between the market needs of LMS functions and features, and Blackboard's constant adding to the number of LMS features. Ultimately, the self-reinforcement itself and the feature-ridden LMS of Blackboard became routine and resource rigidities. Apart from the rigidities within incumbent organization, there were external network lock-ins as rigidities from the customers and investors of incumbent Blackboard.

## 5.4. Conclusion

The preconceptions in Figure 2 are discussed and triangulated with the theoretical propositions in Table 14 to arrive at a more realistic perspective of overshooting and its antecedents and consequences. On the first place, the preconception of the compromised performance as overshooting is mostly related to the proposed construct of mission prioritization overshooting. Compromised performance as overshooting implies that certain overshot customers weighs more of the compromised or traded off performance characteristics or missions of product more than those overprovided. Mission prioritization overshooting explains complementarily that incumbent may prioritize certain missions or performance characteristics of product for the management of incumbent perceive those performance characteristics or mission to be

important, which compromise and overlook certain performance characteristics or mission needed by certain customers. Therefore, certain customers will thus suffer from the compromised performance as overshooting.

Secondly, the proposed construct of market penetration overshooting is associated mostly with the preconception of nonabsorbable performance as overshooting. The compromised performance as overshooting suggests that the compromised performance characteristics of product may adversely affect the capacity of customers to absorb the performance characteristics in trade-off with the compromised ones. On another side, market penetration overshooting complements that the self-reinforcement between incumbent product lines and prioritized market needs by incumbent constantly escalates incumbent's trading off or compromising certain performance characteristics. When the compromise is escalated to the extent of adversely affecting mainstream customers' capacity to absorb the product performances or product missions they need, nonabsorbable performance as overshooting may ensue.

The refined understanding of overshooting also better predicts disruption as consequence. Disruptive innovation is a phenomenon relative to incumbent product (Christensen, 2006a), which implies that disruptive innovation should be interpreted from the perspective of its relationship to incumbent product. The preconceptions in the literature review suggests that there are trade-off-reversing and trade-off-breaking disruptions (Christensen, 1997; Christensen *et al.*, 2018), which are in line with previous observations that disruptive innovation initially take foothold in the markets peripheral to the mainstream market of incumbent and later encroach into the mainstream market of incumbent (Govindarajan, Kopalle and Danneels, 2011; Van Orden, van der Rhee and Schmidt, 2011; Rhee, Schmidt and Van Orden, 2012; Christensen, Raynor and McDonald, 2015). This chapter delineates the relative relationships of trade-off-reversing and trade-off-breaking disruptions to compromised and

nonabsorbable performances as overshooting committed by incumbent. Also, the proposed constructs of mission reprioritization disruption and market development disruption explains from the perspective of disruptors about their disruptive advantages relative to incumbent which commits mission prioritization overshooting and market penetration overshooting.

This research also proposes that misfit overshooting from supply perspective could make for both compromised performance or nonabsorbable performance as overshooting from demand perspective. However, unlike mission prioritization overshooting and market penetration overshooting, customers are not overshot by incumbent's legacy product but by incumbent's emulation on disruptive innovation. In other words, the emulation on disruptive innovation has already alleviated compromised or nonabsorbable performance as overshooting for the emulated disruptive innovation is in itself trade-off-reversing or trade-off-breaking disruptions. However, as of the misfits internal and external to incumbent, the trade-off is not so well reversed or broken by the emulation on disruptive innovation as the disruptive innovation itself, which makes for misfit overshooting and consequent disruption based better fit.

This chapter later discusses the refined understanding of overshooting and disruptive innovation in terms of their contributions in literatures. The key contributions include the refined understanding of overshooting from demand perspective, supply perspective and value network perspective (Rosenbloom and Christensen, 1994; Gilbert, 2005; Henderson, 2006; Wessel and Christensen, 2012; King and Baatartogtokh, 2015; Vecchiato, 2017; Guo *et al.*, 2019). Furthermore, this chapter sheds some new lights on the mechanism driving another category of disruptive innovation – mainstream market disruption (Christensen, Raynor and Mcdonald, 2016). Finally, the case of incumbent Blackboard is reviewed to add new evidence to the theory of path dependence process (Driel and Dolfsma, 2009; Schreyogg and Sydow, 2011; Dobusch and Schussler, 2012).

# 6. CHAPTER SIX: CONCLUSIONS

## 6.1. Introduction

This research interprets the shaping process of overshooting and consequent disruption in the trilogy of mission prioritization overshooting, market penetration overshooting and misfit overshooting from supply perspective as well as the decomposed dimensions of overshooting and consequent disruptions from demand perspective. The trilogy of overshooting is involving three different sets of antecedents and consequent disruptions. However, this research does not encompass prior researches as subsets but triangulate with prior ones to achieve a more balanced perspective. Therefore, the following section will be about the theoretical contributions of this research to research questions in relative to the key contributions from previous researches. Next, the managerial implications of the theoretical discoveries will be discussed. Finally, this chapter will be concluded by pointing out the limitations of this research and the directions for future researches.

## 6.2. Theoretical Contributions

This research is motivated by the intrinsic human nature that people are hardly ever satiated with what they get, which is contradictory with prior researches that consumers can be overshot by too much of a good thing (Christensen, 1997; Chen, Reilly and Lynn, 2012; Lukas *et al.*, 2013). The contradiction motivates the investigation towards the antecedents and consequences of overshooting in the context of an highly related phenomena – disruptive innovation (Christensen *et al.*, 2018). By reviewing academic debates and the research questions of this research, this research is theoretically contributing to the research questions in the ways summarized in the Table 15 as follows:

**Table 15: Theoretical Contributions to Research Questions**

| Research Questions | Key Contributions from Prior Researches | Contributions from This Research |
|---|---|---|
| **What is overshooting?** | Overshooting indicates the situation as *"technologists were able to provide rates of performance improvement that have exceeded the rates of performance improvement that the market has needed or was able to absorb*" (Christensen, 1997 p.144);<br><br>However, both case and large-sample evidences are unsupportive of the relationship between 'oversupplied performance as overshooting' and disruption (Sood and Tellis, 2010; King and Baatartogtokh, 2015; Zhang, 2015; Guo *et al.*, 2019);<br><br>High-end and mainstream customers are overshot because of the diminishing utility generated from the overconcentration on limited performance dimensions (Christensen, 1997; Adner, 2002). | This research further clarifies the decomposition of overshooting that:<br><br>Firstly, the overprovisions of performances unneeded by customers makes the performance characteristics traded off or compromised needed by customers unworthwhile for customers from the peripheral markets of incumbent is key mechanism as the first dimension of overshooting (Compromised Performance as Overshooting);<br><br>Secondly, high-end and mainstream customers are not overshot because of overconcentrated performance but because the traded off or compromised provision of product performance characteristics makes the improved performance characteristics needed by customers difficult to be absorbed or to be turned into meaningful utility (Nonabsorbable Performance as Overshooting). |
| **How and Why is Overshooting Caused?** | Previously documented antecedents of overshooting can be grouped as three types: **Customer-facing factors**: Satisfy customers with intensive demand on certain product performance metrics (Adner, 2002) or customers' intrinsic desire for the better (Adner and Snow, 2010); Path-dependent resource allocation for mainstream customers (Christensen & Bower, 1995); Managerial belief about customer needs (Vecchiato, 2017); **Competence-trap factors**: product architecture (Henderson& Clark, 1990), incentives (Kaplan and Henderson, 2005; Sterman *et al.*, 2007), | The relationships between the constructs of compromised performance as overshooting and mission prioritization overshooting from this research supports the previously documented customer-facing factors but complements them that customer-facing factors will not mainly cause overshooting in the high-end and mainstream markets but in the low-end and peripheral markets.<br><br>The relationship between the constructs of nonabsorbable performance as overshooting and market penetration overshooting from this research supports the previously documented competence-trap factors but complements them that competence-trap factors are not mainly causing |

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| | Relational Contract (Gibbons and Henderson, 2012); Heuristics based on prior success (Barnett and Pontikes, 2008), perceiving disruption as threat to cause routine rigidity (Gilbert, 2005); Rigidified customer-facing competences (Henderson, 2006); dominant logic or cognitive frame about business model (Chesbrough, 2010; Thrane, Blaabjerg and Møller, 2010), technical competences (Yu and Hang, 2011; Nagy, Schuessler and Dubinsky, 2016), aggressive culture (Lukas *et al.*, 2013); **Value-network factors**: incumbent's value network (Rosenbloom and Christensen, 1994), complementary distribution network and R&D alliance (Changsu and Jong-Hun, 2010; Parry and Kawakami, 2017); government regulations (Ruan, Hang and Wang, 2014); downstream complementary assets and customers (Adner and Kapoor, 2010; Roy and Cohen, 2017). | overshooting in the low-end and peripheral markets but in the high-end and mainstream markets.<br><br>This research also evidences that both compromised performance and nonabsorbable performance as overshooting may also happen if any stakeholder of incumbent's value network turns out to be a misfit into the organic value network of disruptive innovation as incumbent emulates and commercializes disruptive innovation. Particularly, this research provides evidence against previous research claiming that incumbent's emulation on disruptor will be successful if incumbent is not taking disruptive innovation as threat (Gilbert, 2005). The opposite evidence indicates the external misfits may still refrain incumbent from successfully emulating or commercializing disruptive innovation even incumbent has taken disruptive innovation as opportunity but threat.<br><br>This research also provides evidences about which type of the previously documented factors may take more salient effects in causing overshooting throughout the complete overshooting process. To be specific, the customer-facing factors is most likely to cause overshooting at the meta-routine stage of overshooting. At self-reinforcement stage, competence-trap factors will take over as more salient factors in causing overshooting. At the lock-in stage of overshooting, value-network factors will ensue to exert more effects in causing overshooting. |
| **How and Why does Overshooting Brings about Disruption?** | **Disruption in the low-end and peripheral markets**: overshooting may satisfy high-end and mainstream market with intensive demand on certain performance characteristics of product but give opportunity to rival disruptive innovation to encroach into low-end or peripheral markets with intensive demand on alternative performance characteristics (Adner, 2002; Christensen, 1997; Schmidt & Druehl, 2008);<br><br>**Disruption in the high-end and mainstream markets**: Overshooting may give opportunity to | This research clarifies the relationship between overshooting and disruption in the low-end and peripheral markets that compromised performance as overshooting gives the opportunity for disruptor to reverse the trade-off held by incumbent product by reducing the focally improved performance characteristics of incumbent product and improving the performance characteristics compromised or traded off by incumbent product but needed by certain customers (trade-off-reversing disruption);<br><br>This research clarifies the relationship between overshooting and disruption in the high-end and mainstream markets that nonabsorbable performance as overshooting gives the opportunity for disruptor to |

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|---|---|---|
| | disruptor encroaching into high-end and mainstream market of incumbent if the disruptor can break the trade-off between the overshooting performance dimensions and disruptive performance dimensions of product (Christensen, McDonald, Altman, & Palmer, 2018; Wessel & Christensen, 2012); However, it is not necessary for disruptor to equally break the trade-off between the overshooting and disruptive performance dimensions of product to encroach into the high-end or mainstream market of incumbent (Van Orden, van der Rhee and Schmidt, 2011; Rhee, Schmidt and Van Orden, 2012). | transform the trade-off relationship between disruptive and overshooting performance dimensions of incumbent product into synergic relationship in disruptive product. The synergic relationship enables high-end and mainstream customers to better absorb the overshooting performance dimension in disruptive product or turn the overshooting performance dimension into more product utilities (trade-off-breaking disruption).<br><br>This research further reveals from supply perspective that trade-off-breaking disruption is enabled through disruptor's adoption of market development strategy by adapting its product line for the mainstream customers of incumbents. In this market development process, 'bypass capability' will make disruptive performance dimension no longer in trade-off but in synergy with the overshooting performance dimension. |
| **How does Over-shooter Cope with Overshooting?** | Incumbent may cope with disruptions by setting up a separate company to emulate disruptive innovation or reversing overshooting performance (Christensen, 1997), extending overshooting performance (Adner and Snow, 2010), combining the overshooting performance dimensions with new performance dimension of product (Charitou and Markides, 2003; Raffaelli, 2018), changing managerial cognition (Thrane, Blaabjerg and Møller, 2010; Vecchiato, 2017), taking disruptive innovation as opportunity (Gilbert, 2005), connecting with new downstream customers and complements (Adner and Kapoor, 2010), building up organisational ambidexterity (O'Reilly and Tushman, 2008) or adjusting organisational identify (Kammerlander, König and Richards, 2018). | This research implies about the match between the previously documented coping strategies and the stage of overshooting process or dimension of overshooting: At meta-routine stage, incumbents should handle on the issues like managerial cognition and organisational identity (Thrane, Blaabjerg and Møller, 2010; Vecchiato, 2017; Kammerlander, König and Richards, 2018), which helps to cope with mission prioritization overshooting; At self-reinforcement stage, incumbent needs to overcome its inertias of responding to disruption residing more in various resource or routine rigidities (Anderson and Tushman, 1986; Rebecca and Kim, 1990; Gilbert, 2005; Kaplan and Henderson, 2005; Gibbons and Henderson, 2012), which helps to deal with market penetration overshooting; At lock-in stage, incumbents need to solve the its misfits with the organic value network of disruptor both internal and external to incumbent so as to overcome misfit overshooting (Tripsas, 1997; Adner and Kapoor, 2010; Parry and Kawakami, 2017; Roy and Cohen, 2017). |

As illustrated by Table 15, overshooting is initially defined as the oversupplied product performance and nonabsorbable product performance (Christensen, 1997). However, researches thereafter tend to define overshooting as the oversupply of product performance (Christensen, 1997; Thompson, Hamilton and Rust, 2005; Chen, Reilly and Lynn, 2012; Lukas *et al.*, 2013), which is contradictory to the intrinsic human desire to get more in spite of the diminishing return in getting more. This research further clarifies that it is the compromised performances characteristics of product but not the oversupplied performance characteristics of the product overshooting customers. The trade-off between the improvement on different performance characteristics makes for the compromised performance as overshooting.

This research further clarifies the overshooting involves two decomposed dimensions: firstly, the overprovisions of performances unneeded by customers makes the performance characteristics traded off or compromised needed by customers unworthwhile (compromised performance as overshooting); secondly, the traded off or compromised provision of product performance characteristics makes the improved performance characteristics needed by customers difficult to be absorbed or to be turned into meaningful utility (nonabsorbable performance as overshooting).

The construct of nonabsorbable performance as overshooting clarifies the mechanism of overshooting in the high-end and mainstream market of incumbent. Previous researches contend that high-end and mainstream customers are overshot because of the diminishing utility generated from the overconcentration on limited performance dimensions (Christensen, 1997; Adner, 2002). However, this research evidences that high-end and mainstream customers are not overshot because of ‘overconcentrated performance’ but because the traded off or compromised provision of product performance characteristics makes the improved performance characteristics needed by customers difficult to be absorbed or to be turned into meaningful utility (Nonabsorbable Performance as Overshooting).

The clarified decomposed dimensions of overshooting also contribute to the explanation of its important consequence – disruption. Previous research explains the disruptive mechanism consequent to overshooting that overshooting may satisfy high-end and mainstream market with intensive demand on certain performance characteristics of product but give opportunity to rival disruptive innovation to encroach into low-end or peripheral markets with intensive demand on alternative performance characteristics (Adner, 2002; Christensen, 1997; Schmidt & Druehl, 2008);

This research contends that the compromised performance as overshooting is the cause of low-end and peripheral-market disruptions. This research clarifies the relationship between overshooting and disruption in the low-end and peripheral markets that compromised performance as overshooting gives the opportunity for disruptor to reverse the trade-off held by incumbent product by reducing the focally improved performance characteristics of incumbent product and improving the performance characteristics compromised or traded off by incumbent product but needed by certain customers (trade-off-reversing disruption). However, this research supports previous researches from supply perspective that trade-off-reversing disruption is enabled by disruptor's reprioritization of the product missions and needs of its targeted markets (Henderson, 2006; Vecchiato, 2017).

The disruptive mechanisms consequent to the nonabsorbable performance as overshooting is also discovered by this research. Prior research proposes that overshooting may give opportunity to disruptor encroaching into high-end and mainstream market of incumbent if the disruptor can break the trade-off between the overshooting performance dimensions and disruptive performance dimensions of product (Christensen, McDonald, Altman, & Palmer, 2018; Wessel & Christensen, 2012). This research clarifies the relationship between overshooting and disruption in the high-end and mainstream markets that nonabsorbable performance as overshooting gives the opportunity for disruptor to transform the trade-off

relationship between disruptive and overshooting performance dimensions of incumbent product into synergic relationship in disruptive product. The synergic relationship enables high-end and mainstream customers to better absorb the overshooting performance dimension in disruptive product or turn the overshooting performance dimension into more product utilities (trade-off-breaking disruption).

This research further reveals from supply perspective that trade-off-breaking disruption is enabled through disruptor's adoption of market development strategy by adapting its product line for the mainstream customers of incumbents. In this market development process, 'bypass capability' will make disruptive performance dimension no longer in trade-off but in synergy with the overshooting performance dimension. This discovery contributes to the stream of literatures regarding in the pursuit of the explanations towards the high-end and mainstream-market disruptions as well (Markides, 2006b; Rhee, Schmidt and Van Orden, 2012).

On another side, this research also makes the proposition that the antecedents of overshooting are associated with three different underlying mechanisms of path dependence process from supply perspective (Schreyogg and Sydow, 2011). The antecedents of overshooting can be related to a wide variety of researches concerning with the path-dependent behaviours of a company (Methodist, 1986; Henderson *et al.*, 1990; Tripsas, 1997; Atuahene-gima, 2005; Gilbert, 2005; Henderson, 2006; Kim, 2006; Barnett and Pontikes, 2008; Thrane, Blaabjerg and Møller, 2010). However, the intricate relationships between those different causes of overshooting calls for the understanding towards which antecedent would take more effects in causing overshooting throughout overshooting process? This research suggests that the path dependence process may act as the underlying mechanisms driving companies throughout the complete process of overshooting.

According to existing literatures, the causes of overshooting are mainly from three types of factors which are summarized in Table 15. Among those factors, the customer-facing factors causing overshooting are more associated with the mission perception as the antecedent of overshooting for customer-facing factors are generally about the rightful recognition of customer needs. Competence-trap factors can be more related to product-market reinforcement as the antecedent of overshooting for those competence traps could be the various resource or routine rigidities resultant from the market penetration strategy from incumbent . Finally, the value-network factors tend to be more related to the internal and external misfits manifested as incumbent tries to emulate disruptive innovation. Therefore, customer-facing factors are more important to cause overshooting at its initial stage which is followed up by competence-trap factors and value-network factors.

Through the theoretical lens of path dependence process, mission perception is found out to be the antecedent of overshooting associated with the meta-routine mechanism of path dependence. Product mission is the job to be done by using a product (Ansoff, 1957). As product mission perceived by management captures the market opportunity for product concept generation, it will act as the meta-routine generated from the front-end stage of product development to influence the back-end stages including product innovation, development process and business model construction. As a consequence, the missions compromised by incumbent product will leave out opportunities to disruptors reprioritizing the compromised missions.

However, the ‘product mission – mission prioritization overshooting – mission reprioritization disruption’ framework only explains the relationship between overshooting and its consequent disruption in the low-end or peripheral markets of incumbent product. According to prior researches, disruptive innovation does not only perform better on the ancillary dimension of incumbent product but also improves later to perform good enough on the core dimension of

incumbent product to achieve full disruption (Adner, 2002; Christensen, 2006a; Schmidt and Druehl, 2008a). This research reveals that the later improvement on the core dimension of incumbent product is caused by incumbent's market penetration overshooting. This form of overshooting is associated with the mechanism of self-reinforcement between the product line and product mission of incumbent. Through the self-reinforcement process, incumbent product line become too rigid to be extended to serve the low-end and peripheral markets occupied by disruptors (Leonard-Barton, 1992). Instead, disruptors may leverage its bypass capability to adapt their product lines to the performance characteristics appealing to the high-end and mainstream markets of incumbent.

This research highlights the bypass capability of disruptors in enabling full disruption. Bypass capability is defined in this research as the organizational capabilities of disruptors bypassing incumbent's rigidified self-reinforcement between incumbent product lines and incumbent's mainstream market needs. Bypass capability can extend the missions fulfillable or market needs satisfiable by disruptive product lines, which is in line with previous observation that disruptors need to have an 'extendable core' to encroach into the mainstream markets of incumbents (Wessel and Christensen, 2012). The bypass capability further clarifies the nature of the extendable core by pointing out the mechanisms enabling the extendibility of the extendable core.

The relationships between the constructs of compromised performance as overshooting and mission prioritization overshooting from this research supports the previously documented customer-facing factors but complements them that customer-facing factors will not mainly cause overshooting in the high-end and mainstream markets but in the low-end and peripheral markets. The relationship between the constructs of nonabsorbable performance as overshooting and market penetration overshooting from this research supports the previously documented competence-trap factors but complements them that competence-trap factors will

not mainly cause overshooting in the low-end and peripheral markets but in the high-end and mainstream markets.

Apart from mission prioritization overshooting and market penetration overshooting, this research suggests a third form of overshooting – misfit overshooting. Misfit overshooting is caused by the incumbents' emulation on disruptive innovation in the hope of commercializing disruptive innovation. The emulation is an attempt to disentangle from obsolete product line to copy the product line of disruptors. However, the business network of incumbent may still work through the lock-in mechanism to refrain incumbents from emulating disruptors (Rosenbloom and Christensen, 1994; Rothaermel, 2001). The refrained emulation is induced by the strategic misfit between the different sets of operational activities from incumbent and disruptor (Porter, 1996), which leaves out opportunities for disruptors to continue disruption based on their better strategic fit.

In order to successfully copy disruptor, previous researches are concentrated on the successful emulation of disruptive competitors (Charitou and Markides, 2003; Christensen and Raynor, 2003; Gilbert, 2005; O'Reilly and Tushman, 2008). The evidence of this research suggests that to copy disruptor inside incumbent company could be problematic if incumbent considers the emulation as self-cannibalizing, which complement previous evidence that taking disruptive innovation as threat would harm the emulation on disruptors (Gilbert, 2005). However, if the strategic misfit come from customers but not competitors, a hybrid product strategy can be taken to counteract disruption when certain mainstream customers of incumbent are not satisfied with incumbent's emulation on the bypass capability of disruptor. The hybrid product strategy provide as an alternative to previously documented strategies of emulating disruptor in a separate unit (Christensen, 2006a) and specifies the conditions conducive for the success of the strategy (Furr and Snow, 2015; Suarez *et al.*, 2018). Also, investor may act as the misfit

holding incumbent back from successful emulation on disruptive innovation, which is consistent with prior researches (Christensen and Bower, 1995; Burgelman, 2007).

This research also evidences that both compromised performance and nonabsorbable performance as overshooting may also happen if any stakeholder of incumbent product's value network turns out to be a misfit into the organic value network of disruptive innovation when incumbent intends to emulate and commercialize disruptive innovation. Particularly, this research provides evidence against previous research claiming that incumbent's emulation on disruptor will be successful if incumbent is not taking disruptive innovation as threat (Gilbert, 2005). The opposite evidence indicates the external misfits may still refrain incumbent from successfully emulating or commercializing disruptive innovation even incumbent has taken disruptive innovation as opportunity but threat.

The theoretical outcomes of this research also help to understand the disruption based on platformification. This research evidences disruptors do not only reprioritize the adaptability and customizability of product through platformification but also uses their bypass capabilities to ensure the enough performance of functionality and reliability of their platform product. For example, Uber acts as a taxi platform which does not only vertically disintegrates the taxi company to match taxi drivers directly with customers but also ensures those dispersedly located cars to provide as reliable and safe services as those from taxi companies through its platform regulation and governance (Uzunca, Rigtering and Ozcan, 2018). This observation is contradictory with prior researches that disruptors based on platformification are normally consequent to incumbent's oversupplying in product reliability and functionality performances (Christensen, Verlinden and Westerman, 2002; Christensen *et al.*, 2018), which is opposed by this research that the oversupplied performance in functionality and reliability by incumbent product is not compulsory for the disruption based on platformification.

Morevoer, according to literatures, incumbent may cope with disruptions by setting up a separate company to emulate disruptive innovation or reversing overshooting performance (Christensen, 1997), extending overshooting performance (Adner and Snow, 2010), changing managerial cognition(Thrane, Blaabjerg and Møller, 2010; Vecchiato, 2017), combining the overshooting performance dimensions with new performance dimension of product (Charitou and Markides, 2003; Raffaelli, 2018), taking disruptive innovation as opportunity (Gilbert, 2005), connecting with new downstream customers and complements (Adner and Kapoor, 2010), building up organisational ambidexterity (O'Reilly and Tushman, 2008), or adjusting organisational identity (Kammerlander, König and Richards, 2018). However, "as a phenomenon-driven research area, scholars with different theoretical perspectives have brought their own lenses to bear, but these perspectives have evolved independently. The result is a research stream with "*a scattered collection of detailed, within-industry perspectives on the phenomenon without a clear ability to link different mechanisms or articulate boundary conditions*" (Eggers and Park, 2018 p.357).

The theoretical framework in Table 14 may serve as a guideline of responding to disruption in a more holistic perspective. To be specific, This research implies about the sequence of adopting some of the previously documented coping strategies throughout the different stages of overshooting process and the right match between the form of overshooting and coping strategies: at meta-routine stage, incumbents should handle on the issues like managerial cognition and organisational identity (Thrane, Blaabjerg and Møller, 2010; Vecchiato, 2017; Kammerlander, König and Richards, 2018), which helps to cope with mission prioritization overshooting; At self-reinforcement stage, incumbent needs to overcome its inertias of responding to disruption residing more in various resource or routine rigidities (Anderson and Tushman, 1986; Rebecca and Kim, 1990; Gilbert, 2005; Kaplan and Henderson, 2005; Gibbons and Henderson, 2012), which helps to deal with market penetration overshooting; At lock-in

stage, incumbents need to solve the its misfits with the organic value network of disruptor both internal and external to incumbent so as to overcome misfit overshooting (Tripsas, 1997; Adner and Kapoor, 2010; Parry and Kawakami, 2017; Roy and Cohen, 2017).

Finally, the mechanism of compromised performance as overshooting itself suggested by this research implies an effective way to counteract disruption. Compromised performance as overshooting happens when the focally improved performance characteristics of incumbent product is hard to be absorbed due to other performances characteristics ancillary to the focally improved ones are traded off or compromised, like the expensive price and user unfriendliness of Blackboard LMS refrained certain customers from absorbing the abundant features of the LMS. Therefore, incumbent could match its focally improved performance characteristics with another ancillary performance characteristics different from those of disruptive innovations to make customers better absorb its focally improved performance characteristics in a different way.

For example, Desire2Learn LMS integrated ‘personalised learning’ with its focally improved LMS features and functions so that the abundance of features and functions can be personalized according to a wide diversity of learners. The rationale may also well explain previous successful examples of counter-disruption. Swiss watch matched its focally improved mechanical production with craftsmanship, luxury and precision to make customers more appreciate or better absorb mechanical production when confronting the disruption from quartz watch (Raffaelli, 2018). Nintendo matched its focally improved gameplay hardware with the easy but engaging interactions between game and players to counteract the disruption from Sony PlayStation and make consumers absorb more of its gameplay hardware (Charitou and Markides, 2003).

## 6.3. Managerial Implications

### 6.3.1. Solving Innovator's Dilemma

The theoretical discoveries of this research have wide implications in managerial practice. Among those implications, the primary one is to solve innovator's dilemma (Christensen, 1997). As mentioned at the introduction section of this research, managers are frequently in the dilemma of improving certain performance characteristics of product or not. The reason is because managers may improve to the extent of overshooting certain performance characteristics and give opportunities to disruptors from the low-end market or new market (Christensen, 1997; Christensen and Raynor, 2003).

However, the discoveries of this research suggest that the risk of improving product performance does not only rest with overprovision of performance but also with the compromised performance of certain product characteristics. Managers should pay attention to those compromised or overlooked performance characteristics, like price, size, customizability and user-friendliness. The all-around scanning on the compromised or overlooked performance metrics of product is even more necessary than the check on if certain performance metrics of product are overprovided or not. The reason is because customers are not so dissatisfied by getting more than they need but by getting less than they need.

From the case data of this research, LMS customizability, end-user friendliness and personalized learning are the three performance characteristics of LMS compromised by Blackboard's improvement on the number of LMS functions and features. Blackboard failed to recognise the needs on those performance characteristics were from markets sizable enough to sustain its major rivals to set foothold. Therefore, as incumbent constantly improves its focal product performance dimensions, incumbent should pay attention to the markets peripheral to its mainstream market to see if there are product performance dimensions compromised by its

product and adapt product lines to improve those compromised dimensions if the market needs on the compromised product dimensions are promising.

Also, incumbent managers may need to go beyond the prioritized performance dimensions of its product to the performance dimensions ancillary to the prioritized performance dimensions. The reason is because those ancillary performance dimensions or product attributes may affect customers' capacity of absorbing the prioritized performance dimensions of product. In the case data, the LMS customizability, user friendliness and personalised learning could affect customers' capacity of absorbing the abundant features and functions of Blackboard LMS. For example, certain LMS functions could not be turned into utility if they were not user-friendly or customizable for specific purpose. Therefore, incumbent manager should cease to improve the focal dimensions of incumbent product as which severely trade off or compromise important ancillary performance dimensions of product.

Incumbent managers may also pause and ponder if necessary to continue to improve its prioritized performance dimensions of product if which can be improved by alternative product lines. the reason for it is because the alternative product lines can be the bypass capability of disruptive product lines. For example, luxury hotel managers should keep an eye on the development of Airbnb for it has the potential to provide guest rooms as satisfactory as a five-star hotel (Christensen *et al.*, 2018). Also, managers need to pay attention to products likely to converge with the missions of their own products, like a phone case company need to keep close track of battery case technology for which might well make battery phone case light and thin enough to disrupt plastic phone case. In the case data, incumbent Blackboard should have ceased to improve LMS functions and features based on its own product lines and switched to see why Moodle and Canvas were able to provide as numerous LMS functions and features as Blackboard based on alternative product lines of Moodle and Canvas.

### 6.3.2. Overcoming Incumbent's Inertia

To respond successfully to disruption, incumbent needs to overcome the inertias associated with their obsolete product lines or market needs. On the first place, the managerial cognition of market needs may be necessary to be altered when incumbents confront disruption. For example, Blackboard founders failed to recognise the missions fulfillable by Moodle and Canvas LMS. Later, the situation was radically changed as the founders stepped down their leadership of company. Desire2Learn had the same problem but which was solved by incorporating outsiders from customer service background. Therefore, reconfiguring top executive team may help to alleviate the problem of cognitive inertia associated with overshooting obsolete product performances.

After shrugging off the cognitive inertia, managers will find certain performance characteristics of product corresponding to new market needs worthwhile to invest or improve. However, managers may find their existing product line too rigid and inflexible to be extended to improve the new performance characteristics worthy of further improvement due to various resource or routine rigidities. For example, Blackboard later realised that its products were all proprietary, products were not built for teachers and students but for IT administrators and its new innovations were not integrated into its core LMS. All that made Blackboard's product line hardly adaptable to rival the LMS from Moodle, Canvas and Desire2Learn.

In the face of rigidified product lines, incumbent may consider radical self-cannibalization to copy disruptive innovation. However, this research suggests that the key is not to copy disruptor but to copy the bypass capability of disruptive innovation. The bypass capability is the alternative means or product lines to bypass incumbent product lines to satisfy the market needs targeted by incumbent product lines. In case data, it was not effective for Blackboard just copy Moodle if Blackboard did not want to use open source software to serve its mainstream market. By the same token, it was not effective to counteract Canvas if Blackboard

could not copy Canvas' product lines in serving the mainstream customers of Blackboard with abundant LMS number of features. Canvas' product lines made the abundance of LMS features in a way different from Blackboard and Canvas achieved so through SaaS service and Cloud technology to respond directly to requests on LMS features from customers. Without fully coping and using the bypass capability of disruptive innovations, coping disruptive innovation may just be inadequate to stopping disruptors from serving the mainstream market needs of incumbent.

After copying the bypass capability of disruptive innovation, managers should take on a value network perspective to see if there are any actors within the value network of incumbent are not fitting to that of disruptor. Particularly, managers should pay attention to customers and investors and hedge against misfits brought about by any of the actors from existing value network. For customers, managers should see if customers are satisfied with their emulated disruptive innovation. If customers are not satisfied with the emulated disruptive innovation due to its inferior performance to incumbent product, managers may develop a hybrid product combining the performance characteristics of both incumbent and disruptive innovation. The hybrid product will be capable of fulfilling product missions meaningful for both incumbent customers and customers of disruptive innovations, which can discontinue incumbent from losing customer base to disruptors. Finally, managers need to check about if investors are supportive of the emulation on disruptive innovation.

However, if incumbent finds it too self-cannibalizing or itself too inertial to copy disruptive innovation, another strategy can be used by incumbent managers to counteract disruptor is to adapt product line for new missions or market needs hardly servable by disruptors. For example, Desire2Learn LMS in this research successfully adapted its product line for the new mission of personalized learning, which turned itself from being disrupted into being disruptive. By doing so, Desire2Learn avoid the self-cannibalization to become open source because the

personalised learning capability of LMS entailed advanced technologies including artificial intelligence and big data which were yet mature to be sufficiently supported in open source environment. Also, the personalised learning capability was integrated into the core LMS of Desire2Learn, which caused inertia for Blackboard to copy for its investors did not support new product capabilities bringing in no substantial market expansion and much extra revenues.

### 6.3.3. Making Disruptive Innovation

Since the birth of the concept – disruptive innovation, a stream of literatures has pursued the means through which disruptive innovation can be made (Markides, 2006b; Yu and Hang, 2011; Wan, Williamson and Yin, 2015; Nagy, Schuessler and Dubinsky, 2016). However, those means do not necessarily result in disruptive innovation. For example, some researchers claim that disruptive innovation can be coming out of a different company ownership or different technical standard (Nagy, Schuessler and Dubinsky, 2016). Obviously, a lot of innovations, rather than disruptive innovations, are based on different ownership or technical standards, like the online calling was technically different from offline calling but online calling was still not disruptive over Dell's business model.

The constructs of market development disruption and trade-off-breaking disruption may imply about the making of disruptive innovation. The two constructs in this research does not only emphasize the trade-off relationship between the prioritized performance characteristics of incumbent product and the reprioritized performance characteristics of disruptive product. Apart from the trade-off, the reprioritized performance characteristics can be improved to help customers to better absorb the prioritized performance characteristics of incumbent product as part of the mechanism of trade-off-breaking disruption. However, previous researches tend to pay more attention to the trade-off while neglect the improved capacity of absorbing the prioritized performance characteristics enabled by the synergy between the prioritized and reprioritized product performance to explain how disruption comes into being (Wessel and

Christensen, 2012; Christensen *et al.*, 2018). Nevertheless, the phenomenon of the synergy is observed as that disruptive innovation tends to be the cheaper, smaller, more convenient or more accessible version of incumbent product (Christensen, 1997). The cheapness, smaller size or convenience are the reprioritized performance characteristics of disruptive product in synergy with the prioritized performance characteristics of incumbent product.

This research claims that accentuating the performance characteristics in synergy with the prioritized performance characteristics of incumbent product could be a way to make disruptive innovation. The synergy manifests itself in two forms which are 'augmentation and coordination'. Augmentation means the accentuated performance characteristics help to augment the utility of the prioritized performance characteristics of incumbent product. For example, the end-user friendliness of Canvas LMS enables teachers and students to put LMS functions and features into full play. The customizability of Moodle LMS enables institutions to adapt the LMS features and functions to their specific needs. Coordination indicates the accentuated and the prioritized performance characteristics of product coordinate each other to achieve the more utilities of putting the two performance characteristics together. For example, Canvas LMS used SaaS model and cloud technology to meet the needs of both the teachers and students as end-users and IT administrators, so IT administrators had the convenience of performing maintenance without interrupting the usage of LMS by teachers and students.

In order to make the synergy feasible in disruptive product, disruptors need to go further to use the product lines accentuating the performance dimensions in synergy with core performance dimension of incumbent product to improve the core performance dimension within disruptive innovation. In other words, disruptors need to develop the bypass capabilities of disruptive product to walk around the trade-off held by incumbent product to provide the core performances dimensions used to be provided by incumbent product. For example, Moodle in this research used freelance developers from Moodle Community to develop LMS features

which are also the core performance dimension of Blackboard and those freelance developers walk around the proprietary developers of Blackboard which would trade off LMS customizability.

There is also another way to make disruptive innovation. Instead of starting from the performance dimensions in synergy with the focally improved performance dimension of incumbent product, disruptors may choose to start from the performance dimensions in trade-off with the focally improved dimensions of incumbent product. To ensure emergence of the trade-off, disruptive innovation can be made through the self-cannibalization of incumbent product. However, incumbent product must be self-cannibalized in a way to generate other performance dimensions in synergy with the core performance dimensions of the cannibalized product. The idea of product-oriented innovation is the sort of self-cannibalization (Goldenberg and Horowitz, 2003).

There are five means of product-oriented innovation which includes Discontinuous Technical Standard (Nagy, Schuessler and Dubinsky, 2016), Subtraction, Multiplication, Division, and Task Unification (Goldenberg and Horowitz, 2003). Subtraction means removing redundant or essential components to create additional values for product, like to remove the keyboard of PC to create Tablet. One of Yu and Hang's technological or R&D competence typology - Simplification is similar to Subtraction (Yu and Hang, 2011). Task Unification is to add a new task performance to an existing product, which is similar to the R&D competence considered as Augmentation (Yu and Hang, 2011). Multiplication means to make one or more copies of existing product components like double-bin trash (Goldenberg and Horowitz, 2003). Division means to modularize product components, which is complemented by Wan, Williamson and Yin's research (2015) that modularization competence can be extended from product to process innovation. Finally, Discontinuous Technical Standard indicates the application of

discontinuous technology, like new material, to substitute existing one as process or product innovation (Nagy, Schuessler and Dubinsky, 2016).

Among the five means of making disruptive innovation, discontinuous technical standard, subtraction and division could essentially be the means to accentuate certain performance characteristics to augment the utility of the prioritized performance characteristics of incumbent product. For example, mobile phone is an example of accentuating the portability of landline through subtracting the telephone line of landline to augment the utility of telecommunication in motion. Using plastic container to replace iron container for paint is discontinuous technical standard by using different material to improve the portability and convenience of paint container. Christensen's suggested means of making disruptive innovation – targeting at 'non-consumption' to remould incumbent product is essentially a way of augmenting the utility of incumbent product to benefit the customers who never consumed incumbent product before. In the contrast, division is a way to augment the utility of incumbent product by making incumbent product adaptable for the more customized needs of the customers who previously consumed incumbent product.

Multiplication and task unification are likely be the means to accentuate certain performance characteristics coordinating with the prioritized performance characteristics of incumbent product. For example, task unification normally unifies a new task coordinating with the tasks of incumbent product in one product to gain the convenience of utilizing the two or more tasks together, like camera phone. Multiplication is to assign different tasks to the multiplied components or parts of incumbent product so that those different tasks can coordinate with each other, like trash-sorting dustbin. However, the classification is not definite, multiplication may sometimes be carried out for the purpose of augmenting the utility of the prioritized performance characteristics of incumbent product, like the double-edged and triple-edged razor of Gillette.

While the synergy is necessary for making disruptive innovation, the trade-off between the accentuated and the prioritized performance characteristics is also necessary to make incumbent hard to respond to disruptive innovation. If certain performance characteristics can be accentuated without trading off the prioritized performance characteristics of incumbent product, incumbent may easily accentuate the performance characteristics on its own without losing its targeted customers. That rationale also explains why the previously suggested five major means of making disruptive innovation are all the so-called 'product-oriented innovation' entailing the self-cannibalization of incumbent product itself (Goldenberg and Horowitz, 2003). In other words, the synergy needs to be achieved through disrupting incumbent.

Conversely, if there is a product innovation embodying the trade-off but not the synergy, the innovation will not disrupt incumbent product too. For example, a company may try hard to break the trade-off between and combine an electronic shaver and a cell phone, but a shaver phone does not have as much synergy as a camera phone and would not disrupt cell phone as much. To ensure the trade-off happens in synchrony with the synergy. The synergy between the accentuated and the prioritized performance characteristics by disruptive and incumbent products irrespectively is usually realized through the cannibalization of incumbent's resource and routine rigidities between incumbent product line and certain market needs. In the case data of this research, Moodle's open source model cannibalized Blackboard's proprietary business model and Canvas' end-user-oriented development process cannibalized Blackboard's IT administrator-oriented process as Blackboard's routine rigidities. Routine rigidity means the failure to change the organizational processes used for resource investment patterns (Gilbert, 2005 p.741) and Blackboard's routine rigidities is reinforced with the market needs on LMS functions and features.

The trade-off or the synergy could be two sides of one coin, the ends will be reached irrespective of the starting point as the trade-off or the synergy. As discussed, the five means

are Discontinuous Technical Standard, Subtraction, Multiplication, Division and Task Unification some of which are manifested in the making of the LMS of Canvas, Moodle and Desire2Learn. To be specific, Canvas LMS unified the tasks of teachers and students, and IT administrators in itself, which was a manifestation of the means of task unification. Moodle used open-source model to customize LMS for institution-specific needs, which was mainly the embodiment of the means of division through modularizing each features and functions of LMS. Also, the incorporation of the personalized learning capability into Desire2Learn LMS was the reflection of the means of discontinuous technical standard for it introduced artificial intelligence as the new technical standard to realise personalized learning.

### 6.4. Best LMS for Higher Education Institutions

Prior researches in the LMS market tend to be conducted for the purpose of picking out the best LMS (Machado and Tao, 2007; California State University Channel Islands, 2011; Lalande and Grewal, 2012; Poulova, Simonova and Manenova, 2015). The selection criterion is normally to compare the sum of the differently weighted performance characteristics of LMS for the sake of selecting the LMS scored with the highest sum. For example, Moodle and Desire2Learn LMS were evidenced by prior researches that they are less than Blackboard LMS for the number of features but are better in terms of price, customizability and usability (Lalande and Grewal, 2012; Dobre, 2015; Poulova, Simonova and Manenova, 2015). Moreover, Blackboard LMS is assessed in a research to be not so customizable, user-friendly and feature-ridden in spite of its strengthen in functionality (Zanjani *et al.*, 2017).

The theory of compromised performance as overshooting implies that every product is overproviding certain product performances while compromising or undersupplying others. Therefore, the current selection approach of weighing different performance metrics of LMS

and selecting the most favourite one is justifiable. However, according to the construct of nonabsorbable performance as overshooting in this research, institutions with intensive demand on certain product performance characteristics still need to evaluate if any other performance characteristics would trade off or compromise their favoured performance characteristics to adversely affect users' capacity to absorb their favoured performance characteristics of LMS. Therefore, some LMS may score highly for certain performance characteristics but which can hardly be absorbed as meaningful utility due to the mechanism of nonabsorbable performance as overshooting. The current approach and criteria of selecting the best LMS may need to be adjusted to include both performance indicators and utility indicators.

Also, the construct of compromised performance as overshooting emphasizes the trade-off between different performance characteristics of LMS and it can become increasingly aggravated to compromise certain performance characteristics of LMS over time. Overshooting is considered before as something only related to the trade-off between the overprovision of certain performance characteristics of product and the compromise on price (Christensen *et al.*, 2018). These evidences of this research demonstrate that the trade-off could exist among performance metrics including customizability, usability, personalised learning and other product missions or product attributes. Therefore, higher education institutions should not only weigh one performance dimensions against others when come to select the best LMS but also investigate into the business model, product development, production and marketing process to evaluation if certain those lowly or highly rated performance dimensions of LMS are in trade-off with each other.

Another implication from this research is that overshooting is a process and the consequent disruption is also a process. This implication is important for higher education institutions as they come to select the LMS best for them. An LMS company may only experience the one or

two stages of the three overshooting process and disruptive process. Like the market shift of higher education institutions in the past two decades, certain institutions may initially reject Moodle for not offering enough reliability and functionality but later found Moodle adapted its product lines to serve with good enough reliability and functionality. To follow the right trends, higher education institutions may conduct multiple pilot surveys at different points in time or hire industrial analysts to see the evolutions of both market and product instead of judging on one-time pilot of different LMS.

One of most important process evidenced by this research is market development. It took time for Canvas to adapt its product line for the mainstream market of incumbent Blackboard. Similarly, it also took time for the emulated Canvas version – Blackboard Ultra to adapt is product line for the mainstream market of Blackboard. Therefore, it could possibly be too early to reject Blackboard Ultra version for other LMS by certain traditional mainstream customers of Blackboard given the cost of switching (DeShong, Vanderlan and Brannan, 2018). Higher education institutions may resort to the theoretical framework presented as Table 14 to position different LMS companies as they evolve over time and take patience to for the evolution. Also, overshooting is not in itself unconquerable, so Blackboard is getting rid of it and restoring its market leadership (Dimeo, 2017; Feldstein, 2017a; Straumsheim, 2017).

### 6.5.Research Limitations

This research has three drawbacks which might well undermine research quality. Firstly, the constructs or variables developed from case studies are not based on the triangulation of diverse data collection methods. In previous comparative case studies, new constructs or variables are based on diverse data collection sources including interview, survey and documents (Eisenhardt, 1989; Gilbert, 2005; Seidel, 2007). The triangulation of different data collection

methods helps to improve the measurability and internal validity of newly developed constructs or variables (Eisenhardt, 1989). This research does not base new constructs or variables on the solid triangulation of different data collection sources due to researcher's inaccessibility to data and the limited time frame for research. However, researchers managed to triangulate new constructs, variables or relationships with prior theories, different data sources, and different units of analysis through repetitive logic to make up for the undermined internal and external validity of the newly developed constructs, variables or relationships (Sekaran & Bougie, 2010; Yin, 2017).

Another limitation of this research is the generalizability of the theoretical framework in Table 14. This research adopts comparative research method. However, the units of analysis for comparison are limited in number, which causes problems in the generalizability of the theoretical framework from this research. The remedy is to use prior theories to compare with the newly developed theories to ensure the generalization is towards theory but not to a population (Sobh and Perry, 2006a). Also, as some of the theoretical propositions developed from this research are seriously violating existing theory, like compromised product performance versus the oversupplied product performance. The serious violation or anomaly makes a limited number of cases justifiable for its sharp contrast with existing theories (Siggelkow, 2007a).

Finally, the case data in this research is sourced from limitedly primary data. The limitation is largely due to inaccessibility to the insiders of the sampled LMS companies. The highly available public documentation makes up for the shortage of primary data. However, the secondary data are not purposefully made for the research questions of this research and hence likely bias of adopting them. Nevertheless, triangulations are made between the different sources of secondary data to avoid the bias.

### 6.6. Future Research Directions

The theoretical outcomes of this research shed some light in several areas which could be further improved or clarified in future research. The first is the bypass capability of incumbent. The bypass capability is investigated in this research as the key for disruptors to fulfil the missions or serve the needs appealing to incumbent customers and achieve full disruption. However, questions remain about the means through which the bypass capability can be built up. Future research may pay attention this area and the managerial implication of the bypass capability is going to be tremendous.

Secondly, the misfit overshooting is an area entailing further investigation. This research only provides evidences regarding incumbent, mainstream customers and investors as the major source of misfit causing misfit overshooting. Future researches may systematically investigate the sources of misfit so as to better advise incumbents' emulation on disruptive innovation.

Thirdly, this research implies about how to make disruptive innovation. As discussed in the managerial implication section, the two principles of making disruptive innovation are to radically remould incumbent product in the means of either augmenting the utility of incumbent product or coordinating with the utility of incumbent product. However, there are more than one way to augment or coordinate, further nuanced categorisation of making disruptive innovation need to be found out to specify the conditions of making disruptive innovation.

Another area promising for future research is about the appropriate use of hybrid product strategy to avoid misfit overshooting. This research specifies certain conditions under which a hybrid product strategy can be adopted to smooth over incumbent customers' resistance to the emulation on disruptive innovation. However, there are other circumstances in which a hybrid product strategy is appropriate. Future research may systematically investigate the conditions

under which hybrid product strategy can be adopted to alleviate the misfit between incumbent customers and incumbent's emulation on disruptive innovation.

Finally, as pointed out in the research limitation section, this research is limited for not triangulating with different data collection methods and not comparing across a larger number of cases. Future research could thus use different data collection methods and a larger number of cases, even a statistical population, to improve the generalizability of the theoretical framework developed in this research.

## 7. References:

A. James Clark School of Engineering, U. of M. (2012) *Canvas to Replace Blackboard | Electrical and Computer Engineering*. Available at: https://www.ece.umd.edu/news/news_story.php?id=6627 (Accessed: 16 July 2018).

Abernathy, William J. and Clark, K. B. (1985) 'Innovation: Mapping the winds of creative destruction', *Research Policy*. doi: 10.1016/0048-7333(85)90021-6.

Abernathy, W. and Utterback, J. (1978) 'Patterns of industrial innovation', *Journal Title: Technology review. ...*. Available at: http://teaching.up.edu/bus580/bps/Abernathy and Utterback, 1978.pdf (Accessed: 30 April 2014).

Adner, R. (2002) 'When are technologies disruptive? a demand-based view of the emergence of competition', *Strategic Management Journal*, 23(8), pp. 667–688. doi: 10.1002/smj.246.

Adner, R. and Kapoor, R. (2010) 'Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations', *Strategic Management Journal*, 31, pp. 306–333. doi: 10.1002/smj.821.

Adner, R. and Levinthal, D. (2001) 'Demand heterogeneity and technology evolution: implications for product and process innovation', *Management science*. Available at: http://pubsonline.informs.org/doi/abs/10.1287/mnsc.47.5.611.10482 (Accessed: 30 April 2014).

Adner, R. and Snow, D. (2010) 'Old technology responses to new technology threats: Demand heterogeneity and technology retreats', *Industrial and Corporate Change*. doi: 10.1093/icc/dtq046.

Adner, R. and Zemsky, P. (2006) 'A demand-based perspective on sustainable competitive advantage', *Strategic Management Journal*, 27, pp. 215–239. doi: 10.1002/smj.513.

Agnihotri, A. (2016) 'Extending boundaries of Blue Ocean Strategy', *Journal of Strategic Marketing*, 24(6), pp. 519–528. Available at: https://web.b.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=2&sid=f13c2d7e-3e18-425e-a97d-4a41128ef24e%40sessionmgr101.

Ainoa, C. (2017) *Analyst Phil Hill says D2L is vying for market leadership. How did it step away from the competition? Customer empathy. | Cheryl Ainoa | Pulse | LinkedIn*. Available at: https://www.linkedin.com/pulse/analyst-phil-hill-say-d2l-vying-market-leadership-how-cheryl-ainoa (Accessed: 10 March 2018).

Allen, S. (2010) *Utah Education Network Selects Instructure to Provide a Statewide Learning Management System*. Available at: https://www.canvaslms.com/news/press-releases/utah-education-network-selects-instructure (Accessed: 26 July 2018).

Anderson, P. and Tushman, M. L. (1986) 'Technological Discontinuities and Organizational Environments', *Administrative Scienece Quaterly*. doi: 10.2307/2392832.

Andriopoulos, C. and Lewis, M. W. (2009) 'Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation', *Organization Science*, 20(4), pp. 696–717. doi: 10.1287/orsc.1080.0406.

Angelo, J. M. (2002) *Courseware costs soar: blackboard and WebCT rethink pricing models; competition seizes opportunity to price-cut-In the News*, *University Business*. Available at: https://www.immagic.com/eLibrary/ARCHIVES/GENERAL/GENPRESS/U020500A.pdf (Accessed: 8 July 2018).

Ansari, S. (Shaz), Garud, R. and Kumaraswamy, A. (2017) ‘the Disruptor’S Dilemma: Tivo and the U.S. Television Ecosystem’, *Strategic Management Journal*, 37(1), pp. 1829–1853.

Ansoff, H. I. (1957) ‘Strategies for Diversification’, *Harvard Business Review*, 35(5), pp. 113–124.

Araujo, L. and Harrison, D. (1997) ‘Technological Trajectories and Path Dependence’, *International Journal of Industrial Organization*, 15, p. 15.

Arrington, M. (2011) *Instructure Launches To Root Blackboard Out Of Universities*, *TechCrunch*. Available at: https://techcrunch.com/2011/01/31/instructure-blackboard-universities-coates/ (Accessed: 26 July 2018).

Arthur, W. B. (1989) ‘Competing Technologies , Increasing Returns , And Lock-In By Historical Events *’, (March).

Ascione, L. (2015) *Blackboard unveils totally redesigned learning platform - eCampus News*. Available at: https://www.ecampusnews.com/2015/07/21/new-learning-experience-457/ (Accessed: 11 November 2018).

Atuahene-gima, K. (2005) ‘Resolving the Capability – Rigidity’, 69(October), pp. 61–83.

Barmak, S. (2015) *How D2L’s Brightspace is bringing big data to the classroom*, *CANADIAN BUSINESS*. Available at: https://www.canadianbusiness.com/innovation/most-innovative-2015-d2l-brightspace/ (Accessed: 13 November 2018).

Barnett, W. P. and Pontikes, E. G. (2008) ‘The Red Queen, Success Bias, and Organizational Inertia’, *Management Science*, 54(7), pp. 1237–1251. doi: 10.1287/mnsc.1070.0808.

Behrens, E. (2010) *Trico to transition from Blackboard to Moodle – Swarthmore College ITS Blog*. Available at: https://blogs.swarthmore.edu/its/2010/06/10/moodleannouncement/ (Accessed: 25 February 2018).

Bergfeld, J. (2007) *Maryville University Selects Desire2Learn | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/maryville-university-selects-desire2learn/ (Accessed: 20 March 2018).

Bettis, R. a. and Prahalad, C. K. (1995) 'The dominant logic: Retrospective and extension', *Strategic Management Journal*, 16(1), pp. 5–14.

Blackboard (2004) *Blackboard Inc. 2004 Annual Report*.

Blackboard Inc. (2004) *Prospectus for Blackboard Inc*. Available at: https://www.nasdaq.com/markets/ipos/filing.ashx?filingid=3025802 (Accessed: 9 May 2018).

Blackboard Inc. (2007) *BLACKBOARD INC - Annual Report (10-K) NOTES TO CONSOLIDATED FINANCIAL STATEMENTS*. Available at: http://sec.edgar-online.com/blackboard-inc/10-k-annual-report/2008/02/20/section23.aspx (Accessed: 9 May 2018).

Blackboard Inc. (2010) *2010 Blackboard Annual Report*. Available at: https://www.sec.gov/Archives/edgar/data/1106942/000095012311015777/w80900e10vk.htm (Accessed: 6 June 2018).

Blackboard Inc (2004) *Blackboard 2004 Annual Report*. Available at: http://www.annualreports.com/HostedData/AnnualReports/PDF/bbbb2004.pdf (Accessed: 11 May 2018).

Blackboard Inc (2005a) *Blackboard 2005 Annual Report*. Available at: http://www.annualreports.com/HostedData/AnnualReports/PDF/bbbb2005.pdf (Accessed: 11 May 2018).

Blackboard Inc (2005b) *Blackboard 2005 Annual Report*. Available at: file:///Users/apple/Library/Mobile Documents/com~apple~CloudDocs/USB/Methdology 研究方法/Datebase 数据库/Blackboard-larger institution/bbbb2005.pdf (Accessed: 16 May 2018).

Blackboard Inc (2009) *Blackboard Responds to NCCCS Moodle Report | Open Source Collaborative: Moodle Assessment Report*. Available at: https://oscmoodlereport.wordpress.com/2009/10/27/blackboard-responds-to-ncccs-moodle-report/ (Accessed: 8 July 2018).

Blackboard Inc (2010) *Blackboard 2010 Annual Report*. Available at: https://www.sec.gov/Archives/edgar/data/1106942/000095012311015777/w80900e10vk.htm (Accessed: 18 May 2018).

Blackboard Inc (2016) *Blackboard Learn Ultra Experience Available Now*. Available at: http://pages.blackboard.com/news-and-events/press-releases/2016/blackboard-learn-ultra-experience-available-now.aspx (Accessed: 29 August 2018).

Bogers, M. and Horst, W. (2014) 'Collaborative prototyping: Cross-fertilization of knowledge in prototype-driven problem solving', *Journal of Product Innovation Management*, 31(4), pp. 744–764. doi: 10.1111/jpim.12121.

Bohlmann, J. D. *et al.* (2013) 'The interplay of customer and product innovation dynamics: An exploratory study', *Journal of Product Innovation Management*, 30(2), pp. 228–244. doi: 10.1111/j.1540-5885.2012.00962.x.

Bolkan, J. (2015) *Blackboard Acquires X-Ray Analytics for Moodle -- THE Journal*. Available at: https://thejournal.com/articles/2015/07/02/blackboard-acquires-xray-analytics-for-moodle.aspx (Accessed: 3 September 2018).

Brown, S. L. and Eisenhardt, K. M. (1995) 'Product Development: Past Research, Present Findings, and Future Directions.', *Academy of Management Review*, 20, pp. 343–378. doi: 10.5465/AMR.1995.9507312922.

Buchanan, L. (2012) *Private Again and On the Move*, *Inc.* Available at: https://www.inc.com/magazine/201209/leigh-buchanan/life-after-the-inc-500-michael-chasen-blackboard.html (Accessed: 28 April 2018).

Burgelman, R. A. (1991) 'Intraorganizational Ecology of Strategy Making and Organizational Adaptation: Theory and Field Research', *Organization Science*, 2(3), pp. 239–262. doi: 10.1287/orsc.2.3.239.

Burgelman, R. A. (2007) 'A process model of strategic business exit: Implications for an evolutionary perspective on strategy', *Strategic Management Journal*. doi: 10.1002/smj.4250171012.

Burgelman, R. and Grove, A. (1996) 'Strategic Dissonance', *California Management Review*, 38(2), p. 8. doi: 10.2307/41165830.

Burke, P. F. (2013) 'Seeking Simplicity in Complexity: The Relative Value of Ease of Use (EOU)-Based Product Differentiation', *Journal of Product Innovation Management*, 30(6), pp. 1227–1241. doi: 10.1111/jpim.12056.

Burn, T. (2006) *Michael Chasen and Blackboard: agents of change*, *SmartCEO*. Available at: http://smartceo.com/michael-chasen-and-blackboard-agents-of-change/ (Accessed: 12 May 2018).

Butler University (2011) *LMS Evaluation; Project Summary and Supporting Data Learning Management System (LMS) Evaluation 2011-2012*. Available at: http://blogs.butler.edu/lms/files/2011/08/executive-summary.pdf (Accessed: 13 March 2018).

California State University Channel Islands (2011) *Dare to Compare: Blackboard 9 to Moodle / Learning Management System Evaluation Report*. Camarillo CA. Available at: https://www.csuci.edu/tli/ats/lmsreview/finalreport/index.htm (Accessed: 14 July 2018).

Campus Computing Project (2011) *Big Gains in Going Mobile; Slow Movement Towards Cloud Computing*, *The 2011 Campus Computing Survey — The Campus Computing Project*. Available at: https://www.campuscomputing.net/content/2011/10/20/campus-computing-2011-big-gains-in-going-mobile (Accessed: 9 June 2018).

Carson, S. J., Wu, T. and Moore, W. L. (2012) 'Managing the Trade-off between Ambiguity and Volatility in New Product Development', *Journal of Product Innovation Management*, 29(6), pp. 1061–1081. doi: 10.1111/j.1540-5885.2012.00950.x.

Carvalho, A., Areal, N. and Silva, J. (2011) 'Students perceptions of Blackboard and Moodle in a Portuguese university', *British Journal of Educational Technology*, 42(5), pp. 824–841. doi: 10.1111/j.1467-8535.2010.01097.x.

Changsu, K. and Jong-Hun, P. (2010) 'The Global Research-and-Development Network and Its Effect on Innovation', *Journal of International Marketing*, 18(4), pp. 1–16.

Charitou, C. D. and Markides, C. C. (2003) 'Responses to Disruptive Strategic Innovation', *MIT SLOAN MANAGEMENT REVIEW*.

Chawdhry, A., Paullet, K. and Benjamin, D. (2011) 'Comparatively assessing the use of blackboard versus desire2learn: student perceptions of the onlin tolls', 10(June), pp. 47–54. Available at: http://iacis.org/iis/2011/273-280_AL2011_1735.pdf.

Chen, J., Reilly, R. R. and Lynn, G. S. (2012) 'New Product Development Speed: Too Much of a Good Thing?', *Journal of Product Innovation Management*, 29(2), pp. 288–303. doi: 10.1111/j.1540-5885.2011.00896.x.

Chesbrough, H. (2010) 'Business Model Innovation: Opportunities and Barriers', *Long Range Planning*. Elsevier Ltd, 43(2–3), pp. 354–363. doi: 10.1016/j.lrp.2009.07.010.

Chieh, C., Garnsey, E. and Ruan, Y. (2015) 'Technovation Opportunities for disruption', *Technovation*. Elsevier, 39–40, pp. 83–93. doi: 10.1016/j.technovation.2014.11.005.

Chioreanu, J. (2005a) *The Ohio State University Selects the Desire2Learn Learning Platform Institution-Wide | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/the-ohio-state-university-selects-the-desire2learn-learning-platform-institution-wide/ (Accessed: 8 March 2018).

Chioreanu, J. (2005b) *University of Iowa Selects Desire2Learn as Enterprise Learning Solution | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/university-of-iowa-selects-desire2learn-as-enterprise-learning-solution/ (Accessed: 11 March 2018).

Christensen, Clayton M. Suárez, Fernando F. Utterback, J. M. (1998) 'Strategies for survival in fast-changing industries', *Management Science*, 44(12), pp. S207–S220. Available at: http://pubsonline.informs.org/doi/abs/10.1287/mnsc.44.12.S207 (Accessed: 30 April 2014).

Christensen, C. (1997) 'Patterns in the Evolution of Product Competition', *European Journal of Marketing*, 73(2), pp. 117–127.

Christensen, C., Johnson, C. W. and Horn, M. B. (2010) 'Disrupting Class, Expanded Edition: How Disruptive Innovation Will Change the Way the World Learns', *Christensen, C., Johnson, C. W., & Horn, M. B. (2010). Disrupting Class, Expanded Edition: How*

*Disruptive Innovation Will Change the Way the World Learns. *()Preencher, 273. https://doi.org/10.1036/0071592067*()Preencher*, p. 273. doi: 10.1036/0071592067.

Christensen, C. M. (1997) *The Innovator's Dilemma*, *Harvard Business School Press*. Boston MA.

Christensen, C. M. (2006) 'The Ongoing Process of Building a Theory of Disruption', *Journal of Product Innovation Management*, 23(2004), pp. 39–55.

Christensen, C. M. *et al.* (2016) *Disruptive Innovation: Intellectual History and Future Paths*. Cambridge. Available at: https://www.uniba.it/docenti/somma-ernesto/17057_2059672ce9fb4df99f3e2654b9b1c2a9.pdf (Accessed: 6 December 2018).

Christensen, C. M. *et al.* (2018) 'Disruptive Innovation: An Intellectual History and Directions for Future Research', *Journal of Management Studies*, 55(7), pp. 1043–1078. doi: 10.1111/joms.12349.

Christensen, C. M., Anthony, S. D. and Roth, E. A. (2004) 'Seeing What ' s Next'.

Christensen, C. M. and Bower, J. L. (1995) 'Customer power, strategic investment, and the failure of leading firms', 17(September 1993).

Christensen, C. M. and Raynor, M. E. (2003) *Innovators Solution*, *Director*.

Christensen, C. M., Raynor, M. and McDonald, R. (2015) 'What Is Disruptive Innovation?', *Harvard Business Review*, 93(12), pp. 44–53. doi: 10.1353/abr.2012.0147.

Christensen, C. M., Verlinden, M. and Westerman, G. (2002) 'Disruption , disintegration and the dissipation of differentiability', 11(5), pp. 955–993.

Christensen, C., Raynor, M. and Mcdonald, R. (2016) 'Fresh Insights From Clayton Christensen On Disruptive Innovation', *Forbes*, pp. 1–7. doi: http://dx.doi.org/10.1016/0169-2070(93)90052-O.

Christensen, C., Raynor, M. and McDonald, R. (2015) *What Is Disruptive Innovation?*, *Havard Business Review*. Available at: https://hbr.org/2015/12/what-is-disruptive-innovation (Accessed: 19 June 2018).

Christiansen, J. K. *et al.* (2010) 'Living Twice: How a Product Goes through Multiple Life Cycles•', *Journal of Product Innovation Management*, 27, pp. 797–827. doi: 10.1111/j.1540-5885.2010.00753.x.

Cohen, E. (1988) 'Authenticity and commoditization in tourism', *Annals of Tourism Research*, pp. 371–386. doi: 10.1016/0160-7383(88)90028-X.

Cohen, W. M. and Levinthal, D. A. (1990) 'Absorptive Capacity: A New Perspective on Learning and Innovation', *Administrative Science Quarterly*. doi: 10.2307/2393553.

Cohn, S. (2018) *Blackboard Ends Participation in Moodle's Certified Partner Program - Jul 27, 2018*. Available at: http://press.blackboard.com/2018-07-27-Blackboard-Ends-Participation-in-Moodles-Certified-Partner-Program (Accessed: 30 August 2018).

Committee, U. L. T. F. R. and University, I. (2013) *IU LMS pilots - a comparative functional review*. Available at: http://next.iu.edu/reports/Comparative Functional Review.pdf.

Coombs, R. and Hull, R. (1998) '`Knowledge management practices' and path-dependency in innovation', *Research Policy*, pp. 237–253. doi: 10.1016/S0048-7333(98)00036-5.

Corbin, J. M. and Strauss, A. L. (2008) *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 3rd edn. Thousand Oaks: Sage Publication, Inc.

Corley, K. G. and Gioia, D. A. (2004) 'Identity ambiguity and change in the wake of a corporate spin-off', *Administrative Science Quarterly*, 49(2), pp. 173–208. doi: 10.2307/4131471.

Corrocher, N. and Zirulia, L. (2010) 'Switching costs, consumer heterogeneity and price discrimination', *Journal of Economics*, 101(2), pp. 149–167. doi: 10.1007/s00712-010-0149-9.

Course Management System Subcommittee (2007) *Final Report Course Management System Subcommittee*. Baton Rouge. Available at: https://www.immagic.com/eLibrary/ARCHIVES/GENERAL/LSU_US/L070914R.pdf (Accessed: 18 July 2018).

Daft, R. L. and Weick, K. E. (1984) 'Toward of Organizations as Model Interpretation Systems', *Academy of Management Review*, 9, pp. 284–295.

Dahl, B. (2011) *Desire2Blog: Another Switch from Blackboard to Desire2Learn*. Available at: http://desire2blog.blogspot.co.uk/2011/10/another-switch-from-blackboard-to.html (Accessed: 13 March 2018).

Danneels, E. (2002) 'The dynamics of product innovation and firm competences', *Strategic Management Journal*, 23(12), pp. 1095–1121. doi: 10.1002/smj.275.

Danneels, E. (2004) 'Disruptive Technology Reconsidered : A Critique and Research Agenda', *Product Innovation Management*, 21(1), pp. 246–258.

Denning, S. (2015) *Fresh Insights From Clayton Christensen On Disruptive Innovation*, *Forbes*. Available at: https://www.forbes.com/sites/stevedenning/2015/12/02/fresh-insights-from-clayton-christensen-on-disruptive-innovation/#11226854702f (Accessed: 16 January 2019).

Dent, C. (2018) *Moodle ends partnership with Blackboard - Moodle*. Available at: https://moodle.com/moodle-partners/moodle-ends-partnership-blackboard/ (Accessed: 29 August 2018).

DeShong, C., Vanderlan, R. and Brannan, J. (2018) *Cornell Academic Learning Management System Evaluation Project Final Report*. Cornell. Available at: https://it.cornell.edu/sites/default/files/Academic LMS Evaluation/Cornell%27s Academic LMS Evaluation Report_0.pdf (Accessed: 17 July 2018).

Deshpande, R. (1983) 'Paradigms lost': on theory and method in research in marketing"', *Journal of Marketing*, 47(Fall), pp. 101–110.

Dewett, T. and Williams, S. D. (2007) 'Innovators and Imitators in Novelty-intensive Markets: A Research Agenda', *Creativity and Innovation Management*, 16(1), pp. 80–92. doi: 10.1111/j.1467-8691.2007.00421.x.

Dimeo, J. (2017) *LMS Report: Blackboard, Moodle still LMS leaders*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/digital-learning/data/2017/07/12/blackboard-moodle-still-lms-leaders (Accessed: 12 July 2018).

Dobre, I. (2015) 'Learning Management Systems for Higher Education - An Overview of Available Options for Higher Education Organizations', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 180(November 2014), pp. 313–320. doi: 10.1016/j.sbspro.2015.02.122.

Dobusch, L. and Schussler, E. (2012) 'Theorizing path dependence: a review of positive feedback mechanisms in technology markets, regional clusters, and organizations', *Industrial and Corporate Change*, 22(3), pp. 617–647. doi: 10.1093/icc/dts029.

Doherty, K. and Ronalds-Hannon, E. (2018) *Blackboard Debt Takes a Hit After Colleges Drop Its Education Software - Bloomberg*. Available at: https://www.bloomberg.com/news/articles/2018-07-10/blackboard-debt-takes-hit-as-colleges-quit-former-market-darling (Accessed: 29 August 2018).

Dougiamas, M. (1998) *A journey into Constructivism – Dougiamas*. Available at: https://dougiamas.com/archives/a-journey-into-constructivism/ (Accessed: 3 July 2018).

Dougiamas, M. (2007) *Moodle: a case study in sustainability*. Available at: http://oss-watch.ac.uk/resources/cs-moodle (Accessed: 29 June 2018).

Dougiamas, M. (2013) *Don't waste my time just help me do my job!* Available at: Moodle - smaller institution/Martin Dougiamas, Moodle pty ltd SlideShare. (Accessed: 1 July 2018).

Dougiamas, M. and Taylor, P. C. (2003a) *Interpretive analysis of an internet-based course constructed using a new courseware tool called Moodle – Dougiamas*. Available at: https://dougiamas.com/archives/herdsa2002/ (Accessed: 3 July 2018).

Dougiamas, M. and Taylor, P. C. (2003b) *Moodle: Using Learning Communities to Create an Open Source Course Management System – Dougiamas*. Available at: https://dougiamas.com/archives/edmedia2003/ (Accessed: 4 July 2018).

Driel, H. Van and Dolfsma, W. (2009) 'Path dependence, initial conditions, and routines in organizations: The Toyota production system re-examined', *Journal of Organizational Change Management*, 22(1), pp. 49–72. doi: 10.1108/09534810910933906.

Dunleavy, P. (2003) *Authoring a PhD Thesis: How to Plan, Draft, Write and Finish a Doctoral Dissertation*, *Palgrave Study Guides*. doi: 10.1177/1077558710372108.

Earl, P. E. and Potts, J. (2012) 'The creative instability hypothesis', *Journal of Cultural Economics*, 37(2), pp. 153–173. doi: 10.1007/s10824-012-9174-6.

Easterby-Smith, M. and Thorpe, R. (2001) *The Philosophy of Research Design: Management Research: An Introduction*. London: SAGE Publications. doi: 10.1017/CBO9781107415324.004.

Edutechnica (2014) *LMSs of Smaller Colleges*.

Edutechnica (2018a) *Fall 2018 Global LMS Market Share Update | edutechnica*. Available at: http://edutechnica.com/2018/12/08/global-lms-market-share-update/ (Accessed: 4 May 2019).

Edutechnica (2018b) *Sensationalizing LMS Market Share in an Era of Fake News*. Available at: http://edutechnica.com/2018/07/13/sensationalizing-lms-market-share-in-an-era-of-fake-news/ (Accessed: 11 January 2019).

Eggers, J. P. and Park, K. F. (2018) 'Incumbent Adaptation to Technological Change: The Past, Present, and Future of Research on Heterogeneous Incumbent Response', *Academy of Management Annals*, 12(1), pp. 357–389.

Eisen, B. (2009) *A Gripe Session at Blackboard*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/news/2009/07/16/gripe-session-blackboard (Accessed: 13 July 2018).

Eisenhardt, K. M. (1989) 'Building Theories from Case Study Research.', *Academy of Management Review*, pp. 532–550. doi: 10.5465/AMR.1989.4308385.

Eisenhardt, Kathleen M. (1989) ‘Building Theories from Case Study Research’, *The Academy of Management Review*, 14(4), p. 532. doi: 10.2307/258557.

Eisenhardt, K. M. (1991) ‘Better Stories and Better Constructs: The Case for Rigor and Comparative Logic’, *The Academy of Management Review*, 16(3), p. 620. doi: 10.2307/258921.

Eisenhardt, K. M. and Graebner, M. E. (2007) ‘Theory Building From Cases: Opportunities and Challenges.’, *Academy of Management Journal*, 50(1), pp. 25–32. doi: 10.5465/AMJ.2007.24160888.

Empson, R. (2012a) *Blackboard: With Both Co-founders Now Gone, It’s The End Of An Era For The Education Software Giant | TechCrunch*, *Tech Crunch*. Available at: https://techcrunch.com/2012/10/18/with-both-co-founders-now-gone-its-the-end-of-an-era-for-education-software-giant-blackboard/ (Accessed: 23 April 2018).

Empson, R. (2012b) *Blackboard: With Both Co-founders Now Gone, It’s The End Of An Era For The Education Software Giant | TechCrunch*, *TechCrunch*. Available at: https://techcrunch.com/2012/10/18/with-both-co-founders-now-gone-its-the-end-of-an-era-for-education-software-giant-blackboard/ (Accessed: 29 April 2018).

Empson, R. (2012c) *Cisco Teams Up With Instructure To Move The World’s Largest IT Classroom To The Cloud*, *TechCrunch*. Available at: https://techcrunch.com/2012/06/15/cisco-teams-up-with-instructure-to-move-the-worlds-largest-it-classroom-to-the-cloud/ (Accessed: 27 July 2018).

Empson, R. (2013a) *Desire2Learn Acquires Adaptive Learning And Analytics Startup Knowillage | TechCrunch*. Available at: https://beta.techcrunch.com/2013/09/09/desire2learn-acquires-adaptive-learning-and-analytics-startup-knowillage/ (Accessed: 5 March 2018).

Empson, R. (2013b) *Instructure Launches App Center To Let Teachers, Students Install Third-Party Apps Across Learning Platforms*, *TechCrunch*. Available at: https://techcrunch.com/2013/04/12/instructure-launches-app-center-to-let-teachers-students-install-third-party-apps-across-learning-platforms/ (Accessed: 23 July 2018).

Fangqin, Y., Ke, X. and Tong, Z. (2013) *The Decline of SHARP*, *CBN Weekly*. Available at: https://www.cbnweek.com/articles/magazine/7431 (Accessed: 15 January 2019).

Farmer, J. (2006) 'On the Cost of Selling an Enterprise Learning System', *October*, (January), pp. 1–9. Available at: https://www.immagic.com/eLibrary/ARCHIVES/GENERAL/IMM/I060108F.pdf (Accessed: 15 May 2018).

Farmer, J. (2007) *Louisiana State University Moves to Moodle*, *e-Literate*. Available at: https://mfeldstein.com/louisiana-state-university-moves-to-moodle/ (Accessed: 18 July 2018).

Farmer, J. (2008a) *Blackboard, Inc. Analysis, Part 1: Software Licenses* -, *E-Literate*. Available at: https://mfeldstein.com/blackboard-inc-analysis-part-1-software-licenses/ (Accessed: 29 May 2018).

Farmer, J. (2008b) *Blackboard, Inc. Analysis, Part 2: Financial Performance* -. Available at: https://mfeldstein.com/blackboard-inc-analysis-part-2-financial-performance/ (Accessed: 29 May 2018).

Farquhar, J. D. (2012) *Case Study Research for Business*. 1st edn. London: Sage Publications Ltd. doi: 10.4135/9781446287910.

Feldstein, M. (2010a) *Instructure Canvas: A New LMS Entrant*, *e-Literate*. Available at: https://mfeldstein.com/instructure-canvas-a-new-lms-entrant/ (Accessed: 26 July 2018).

Feldstein, M. (2010b) *Instructure Canvas: A New LMS Entrant - E-Literate*. Available at: https://mfeldstein.com/instructure-canvas-a-new-lms-entrant/ (Accessed: 19 September 2018).

Feldstein, M. (2011) *Instructure Goes Open Source*, *eLiterate*. Available at: https://mfeldstein.com/instructure-goes-open-source/ (Accessed: 26 July 2018).

Feldstein, M. (2013) *Yup, Something (Good) Is Up at Blackboard*. Available at: https://mfeldstein.com/yup-something-good-is-up-at-blackboard/ (Accessed: 29 August 2018).

Feldstein, M. (2017a) *BbWorld Report: Blackboard May Be Turning Around*, *E-literate*. Available at: https://mfeldstein.com/bbworld-report-blackboard-may-be-turning-around/ (Accessed: 11 January 2019).

Feldstein, M. (2017b) *BbWorld Report: Blackboard May Be Turning Around*, *E-Literate*. Available at: https://mfeldstein.com/bbworld-report-blackboard-may-be-turning-around/ (Accessed: 29 August 2018).

Flook, B. (2010) *Blackboard buys Elluminate, Wimba - Washington Business Journal*. Available at: https://www.bizjournals.com/washington/stories/2010/07/05/daily39.html (Accessed: 20 August 2018).

Flook, B. (2013a) *Exclusive: Blackboard chief Jay Bhatt brings in Autodesk vets in product centralization push*, *Washington Business Journal*. Available at: http://webcache.googleusercontent.com/search?q=cache:ZAIw6LSpA08J:https://www.bizjournals.com/washington/blog/techflash/2013/06/blackboard-brings-in-autodesk-vets-in.html&num=1&client=safari&hl=en&gl=hk&strip=1&vwsrc=0 (Accessed: 3 September 2018).

Flook, B. (2013b) *Rebuilding Blackboard: How Jay Bhatt plans to resurrect one of D.C.'s original tech startups - Washington Business Journal*. Available at: http://webcache.googleusercontent.com/search?q=cache:v3sVqiY3K0IJ:https://www.bizjournals.com/washington/print-edition/2013/07/26/rebuilding-blackboard-how-jay-bhatt.html&num=1&client=safari&hl=en&gl=hk&strip=1&vwsrc=0 (Accessed: 3 September 2018).

Fox-Wolfgramm, S. J., Boal, K. B. and Hunt, J. G. J. (1998) 'Organizational Adaptation to Institutional Change: A Comparative Study of First-Order Change in Prospector and Defender Banks', *Administrative Science Quarterly*, 43(1), p. 87. doi: 10.2307/2393592.

Furr, N. R. and Snow, D. C. (2015) 'Intergenerational Hybrids: Spillbacks, Spillforwards, and Adapting to Technology Discontinuities', *Organization Science*, (26), pp. 475–493. doi: 10.1287/orsc.2014.0930.

Gartner, S. (2015) *Inside Moodle's user-driven development process*, *opensource.com*. Available at: https://opensource.com/life/15/4/how-moodle-manages-community-feedback (Accessed: 27 June 2018).

Garud, R., Kumaraswamy, A. and Karnøe, P. (2010) 'Path Dependence or Path Creation?', *Journal of Management Studies*, 47(4), pp. 760–774. doi: 10.1111/j.1467-6486.2009.00914.x.

Gibb, W., Alan, L. and Kathleen, M. (1991) 'Better Stories , Not Better Constructs , to Generate Better Theory : A Rejoinder ...'

Gibbons, R. and Henderson, R. (2012) 'Relational Contracts and Organizational Capabilities', *Organization Science*, 23(5), pp. 1350–1364. doi: 10.1287/orsc.1110.0715.

Gibbs Katz, G. (2010) *BeInkandescent: Blackboard Rules: Advice from Two of the Smartest Kids in the Class*. Available at: http://www.beinkandescent.com/tips-for-entrepreneurs/323/the-magic-of-blackboard-inc (Accessed: 28 April 2018).

Gibbs Katz, H. (2010) *Education + Technology = Michael Chasen's Blackboard.com*, *beinkandescent*. Available at: http://www.beinkandescent.com/entrepreneur-of-the-month/322/michael-chasen (Accessed: 4 May 2018).

Gibbs Katz, H. (no date) *BeInkandescent: Education + Technology = Michael Chasen's Blackboard.com*, *2010*.

Gilbert, C. (2005) 'Unbundling the Structure of Inertia: Resource Versus Routine Rigidity.', *Academy of Management Journal*, 48(5), pp. 741–763. doi: 10.5465/AMJ.2005.18803920.

Gilfus, S. (2000) *Blackboard Product Strategy and Development Roadmap*. Available at: http://www.gilfuseducation.com/wp-content/uploads/2000-Bb-Product-Strategy.pdf (Accessed: 8 May 2018).

Gilus, S. (2007) *History of Blackboard and the Blackboard Learning System*, *Gilfus Education*. Available at: https://www.gilfuseducation.com/blackboard-history-and-product-overview/ (Accessed: 8 May 2018).

Glaser, Barney G. and Strauss, A. L. (1967) 'Chapter III: Theoretical sampling', in *The Discovery of Grounded Theory Strategies for qualitative research*. 1st edn. Chicago: Aidine.

Glaser, Barney G and Strauss, A. L. (1967) *The discovery of grounded theory*, *International Journal of Qualitative Methods*. doi: 10.2307/588533.

Glen, D. and Fournier, S. (2013) 'Paradoxes of Technology : Consumer Cognizance , Emotions , and Coping', 25(2), pp. 123–143.

Goldenberg, J. and Horowitz, R. (2003) 'Finding your innovation sweet spot', *Harvard Business …*. Available at: http://search.informit.com.au/documentSummary;dn=153406233982781;res=IELBus (Accessed: 22 May 2014).

Govindarajan, V., Kopalle, P. K. and Danneels, E. (2011) 'The Effects of Mainstream and Emerging Customer Orientations on Radical and Disruptive Innovations', *Journal of Product Innovation Management*, 28(s1), pp. 121–132. doi: 10.1111/j.1540-5885.2011.00865.x.

Gray, D. E. (2009) *Doing Research in the Real World*, *World*. Available at: http://books.google.com/books?id=l4dEQTQl1NYC&pgis=1.

Green, K. (2009) *The 2009 Campus Computing Survey — The Campus Computing Project*. Available at: https://www.campuscomputing.net/content/2009/11/5/the-2009-campus-computing-survey (Accessed: 10 October 2018).

Green, Kennetch (2010) *The 2010 Campus Computing Survey*, *Campus Computing Project*. Available at: https://www.campuscomputing.net/content/2010/10/17/the-2010-campus-computing-survey (Accessed: 12 June 2018).

Green, Kenneth (2010) *The 2010 Campus Computing Survey*, *Campus Computing Project*. Available at: https://www.campuscomputing.net/content/2010/10/17/the-2010-campus-computing-survey (Accessed: 12 June 2018).

Green, K. (2012) *The 2012 Campus Computing Survey — The Campus Computing Project*. Available at: https://www.campuscomputing.net/content/2012/11/12/the-2012-campus-computing-survey (Accessed: 18 March 2018).

Green, K. C. (2010) *The 2010 National Survey of Information Technology in U.S. Higher Education/ITBudget Cuts Are Down; LMS Strategies Are in Transition*. Available at:

https://static1.squarespace.com/static/5757372f8a65e295305044dc/t/586951356b8f5b181085e2ff/1483297104008/Green-CC2010-ExecSummaryGraphics.pdf (Accessed: 11 March 2018).

Green, K. C. (no date) *The 2012 Campus Computing Survey — The Campus Computing Project: A Mixed Assessment on the Effectiveness of Campus IT Investments*. Available at: https://www.campuscomputing.net/content/2012/11/12/the-2012-campus-computing-survey (Accessed: 14 March 2018).

Green, K. C. C. P. (2012) *A Mixed Assessment About the Effectiveness of Campus IT Investments ; More Campuses Go Mobile and Slowly to the Cloud , While Fewer Experience IT Budget Cuts*. Available at: https://static1.squarespace.com/static/5757372f8a65e295305044dc/t/5873b89820099ec947de52f4/1483978912097/Green-CampusComputing2012.pdf.

Guess, A. (2008) *Next Step for Blackboard and Open Source*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/news/2008/10/28/next-step-blackboard-and-open-source (Accessed: 12 July 2018).

Guo, Jianfeng *et al.* (2019) 'Measurement framework for assessing disruptive innovations', *Technological Forecasting and Social Change*, 139(September 2018), pp. 250–265. doi: 10.1016/j.techfore.2018.10.015.

Han, J. K., Chung, S. W. and Sohn, Y. S. (2009) 'Technology Convergence : When Do Products to Dedicated Products ? Convergence Products ':, 73(July), pp. 97–108.

Han, J. K., Kim, N. and Srivastava, R. K. (1998) 'Market Orientation and Organizational Performance : Is Innovation a Missing Link ?', 62(October), pp. 30–45.

Hang, C. C., Garnsey, E. and Ruan, Y. (2015a) 'Opportunities for disruption', *Technovation*. doi: 10.1016/j.technovation.2014.11.005.

Hang, C. C., Garnsey, E. and Ruan, Y. (2015b) 'Opportunities for disruption', *Technovation*, 39–40, pp. 83–93. doi: 10.1016/j.technovation.2014.11.005.

Hannan, M. T. and Freeman, J. (1984) 'Structural Inertia and Organizational Change', *American Sociological Review*, (49), pp. 149–164.

Harper, D. (2006) *Blackboard's Great Business Model*, *INVESTOPEDIA*. Available at: https://www.investopedia.com/stock-analysis/06/blackboard's_great_business_model.aspx (Accessed: 5 July 2018).

Hauser, J. R. (2001) 'Metrics thermostat.pdf', *Journal of Product & Brand Management*, 18(2001), pp. 134–153.

Hayes, R. R. (2016) 'Choosing Between Blackboard and Moodle for Coastal Carolina University'. Wilmington. Available at: http://www.rebeccarhayes.com/assets/hayesbecky_lms_finalproject-(2016_08_22-15_05_38-utc).pdf (Accessed: 14 July 2018).

Healy, M. and Perry, C. (2000) 'Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm', *Qualitative Market Research: An International Journal*. doi: 10.1108/13522750010333861.

Heath, T. (2012) 'Capital Buzz: Parature's former chief executive reprises role - The Washington Post', *The Washington Post*, 27 May. Available at: https://www.washingtonpost.com/business/capitalbusiness/capital-buzz-paratures-former-chief-executive-reprises-

role/2012/05/25/gJQANV72uU_story.html?noredirect=on&utm_term=.80b5da7ec950 (Accessed: 12 May 2018).

Henderson, R. (2006) 'The Innovator's Dilemma as a Problem of Organizational Competence', *Journal of Product Innovation Management*, 23(1), pp. 5–11. doi: 10.1111/j.1540-5885.2005.00175.x.

Henderson, R. (2009) *Learning Lessons, Making Good - Ray Henderson*. Available at: http://www.rayhblog.com/blog/2009/07/le.html (Accessed: 13 July 2018).

Henderson, R. (2012) *News: Michael Chasen Steps Down - Ray Henderson*. Available at: http://www.rayhblog.com/blog/2012/10/news-michael-chasen-steps-down.html (Accessed: 6 June 2018).

Henderson, R. M. *et al.* (1990) 'Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms', *Administrative Science Quarterly*, 35(1), pp. 9–30. doi: Article.

Hensley-Clancy, M. (2014) *Blackboard's Boss Wants You To Hate His Company Less*, *BuzzFeedNews*. Available at: https://www.buzzfeednews.com/article/mollyhensleyclancy/blackboards-boss-wants-you-to-hate-his-software-less#.wqkD9rJ3g (Accessed: 12 November 2018).

Hensley-Clancy, M. (2015) *Blackboard Promises Students Won't Hate Its New Software*, *BuzzFeedNews*. Available at: https://www.buzzfeednews.com/article/mollyhensleyclancy/blackboard-tries-to-win-over-students-with-software-overhaul (Accessed: 2 September 2018).

Herrmann, A., Gassmann, O. and Eisert, U. (2007) 'An empirical study of the antecedents for radical product innovations and capabilities for transformation', *Journal of Engineering and Technology Management*, 24(1–2), pp. 92–120. doi: 10.1016/j.jengtecman.2007.01.006.

Hill, P. (2011a) *Brown University moving from Blackboard to Instructure's Canvas LMS -*, *E-Literate*. Available at: https://mfeldstein.com/brown-university-moving-from-blackboard-to-instructures-canvas-lms/ (Accessed: 13 June 2018).

Hill, P. (2011b) *New Mentality Entering LMS Market*, *e-Literate*. Available at: https://mfeldstein.com/new-mentality-entering-lms-market/ (Accessed: 25 July 2018).

Hill, P. (2012a) *Blackboard Confronts Erosion of Market Share, Makes a Major Change in Strategy -*. Available at: https://mfeldstein.com/blackboard-confronts-erosion-of-market-share-makes-a-major-change-in-strategy/ (Accessed: 13 March 2018).

Hill, P. (2012b) *Lore Announcement Shows Promise of Cloud-Based Platforms: Low Cost of Design*, *e-Literate*. Available at: https://mfeldstein.com/lore-formerly-coursekit-redesign-demonstrates-promise-of-platform-lost-cost-of-development/ (Accessed: 25 July 2018).

Hill, P. (2012c) *Michigan State University Moves from Blackboard's ANGEL LMS to Desire2Learn's Learning Suite | Delta Initiative*. Available at: http://www.deltainitiative.com/bloggers/michigan-state-university-moves-from-blackboards-angel-lms-to-desire2learns-learning-suite (Accessed: 7 March 2018).

Hill, P. (2014) *Two-Year Anniversary of Blackboard Acquisition of Moodlerooms and NetSpot -*. Available at: https://mfeldstein.com/two-year-anniversary-blackboard-acquisition-moodlerooms-netspot/ (Accessed: 13 March 2018).

Hill, P. (2015a) *State of the US Higher Education LMS Market: 2015 Edition - e-Literate*. Available at: https://mfeldstein.com/state-of-the-us-higher-education-lms-market-2015-edition/ (Accessed: 17 October 2018).

Hill, P. (2015b) *Why Is Blackboard Laying Off Staff Despite Improved Market Share Position? -*, *E-Literate*. Available at: https://mfeldstein.com/why-is-blackboard-laying-off-staff-despite-improved-market-share-position/ (Accessed: 30 August 2018).

Hill, Phil (2016a) *After Customer Feedback And Further Delays, Blackboard Changes Learn Ultra Strategy For LMS*, *E-Literate*. Available at: https://mfeldstein.com/after-customer-feedback-and-further-delays-blackboard-changes-learn-ultra-strategy-for-lms/ (Accessed: 1 September 2018).

Hill, Phill (2016) *Changes at D2L: A second-hand view from users conference -*. Available at: https://mfeldstein.com/changes-d2l-second-hand-view-users-conference/ (Accessed: 10 March 2018).

Hill, Phil (2016b) *Previous LMS For Schools Moving to Canvas in US and Canada*, *E-literate*. Available at: https://mfeldstein.com/previous-lms-schools-moving-canvas-us-canada/ (Accessed: 11 January 2019).

Hill, Phil (2017a) *InstructureCon 2017: Culture as a competitive weapon -*. Available at: https://mfeldstein.com/instructurecon-2017-culture-competitive-weapon/ (Accessed: 25 August 2018).

Hill, Phill (2017) *LMS Revival: D2L picking up new customers and showing they can listen -*. Available at: https://mfeldstein.com/lms-revival-d2l-picking-new-customers-showing-can-listen/ (Accessed: 10 March 2018).

Hill, Phil (2017b) *LMS Revival: D2L picking up new customers and showing they can listen -*. Available at: file:///Users/meaaron/Library/Mobile Documents/com~apple~CloudDocs/USB/Methdology 研究方法/Datebase 数据库 /desire2learn/LMS Revival_ D2L picking up new customers and showing they c (Accessed: 6 March 2018).

Hill, Phil (2017c) *Whither Moodle? -*, *e-Literate*. Available at: https://mfeldstein.com/whither-moodle/ (Accessed: 12 June 2018).

Hill, P. (2018a) *Comparing the First Ten Years of Blackboard and Instructure in LMS Market*, *E-Literate*. Available at: https://mfeldstein.com/comparing-the-first-ten-years-of-blackboard-and-instructure-in-lms-market/ (Accessed: 9 September 2018).

Hill, P. (2018b) *Moody's Downgrades Blackboard Debt, Focuses On Learn Ultra Delivery*, *E-Literare*. Available at: https://mfeldstein.com/moodys-downgrades-blackboard-debt-focuses-on-learn-ultra-delivery/ (Accessed: 2 September 2018).

Hill, P. (2019) *State of Higher Ed LMS Market for US and Canada: 2019 Mid-Year Edition - PhilOnEdTech*. Available at: https://philonedtech.com/state-of-higher-ed-lms-market-for-us-and-canada-2019-mid-year-edition/ (Accessed: 20 October 2019).

Hitt, M. A., Hoskisson, R. E. and Ireland, R. D. (1990) 'Mergers and Acquisitions and Managerial Commitment to Innovation in M-Form Firms', *Strategic Management Journal*, 11(4), pp. 29–47.

Howell, K. E. (2013) *An Introduction to the Philosophy of Methodology*. 1st edn, *Sage Publications*. 1st edn. Thousand Oaks and London. doi: 10.4135/9781473957633.

Howell, K. E. and Annansingh, F. (2013) ‘Knowledge generation and sharing in UK universities: A tale of two cultures?’, *International Journal of Information Management*. Elsevier Ltd, 33(1), pp. 32–39. doi: 10.1016/j.ijinfomgt.2012.05.003.

Huang, H.-C. *et al.* (2013) ‘Overcoming organizational inertia to strengthen business model innovation: An open innovation perspective’, *Journal of Organizational Change Management*, 26(6), pp. 977–1002. doi: 10.1108/JOCM-04-2012-0047.

Huesig, S., Timar, K. and Doblinger, C. (2014) ‘The Influence of Regulation and Disruptive Potential on Incumbents’ Submarket Entry Decision and Success in the Context of a Network Industry’, *Journal of Product Innovation Management*, 31(5), pp. 1039–1056. doi: 10.1111/jpim.12143.

Instructional Technology Resource Center (2006) *LMS Pilot Report (Moodle)*. Pocatello. Available at: http://www.isu.edu/itrc/resources/LMS_Focus_Group_Report.pdf (Accessed: 16 July 2018).

Instructure Inc (2011) *Canvas Goes Open Source*. Available at: https://www.canvaslms.com/news/press-releases/canvas-goes-open-source (Accessed: 26 July 2018).

Instructure Inc (2016) :*INST Annual Report 10-K Filling*. Salt Lake City. Available at: http://quote.morningstar.com/stock-filing/Annual-Report/2015/12/31/t.aspx?t=:INST&ft=10-K&d=90a6893a5b48af2d4567295c94b9e4ef (Accessed: 30 July 2018).

Instructure Inc (2018) :*INST Annual Report 10-K Filling*. Salt Lake City. Available at: http://quote.morningstar.com/stock-filing/Annual-Report/2017/12/31/t.aspx?t=:INST&ft=10-K&d=56cb795df30e3117b88f4dbbba040951 (Accessed: 30 July 2018).

Iowa University (2016) *Future of Canvas at the University of Iowa*. Available at: http://teach.its.uiowa.edu/initiatives/unizin (Accessed: 15 March 2018).

Israelsen-Hartley, S. (2010) *BYU grads introduce education-savvy software*, *Desert News*. Available at: https://www.deseretnews.com/article/700040784/BYU-grads-introduce-education-savvy-software.html (Accessed: 21 July 2018).

Jacobs, M. a. and Swink, M. (2011) 'Product portfolio architectural complexity and operational performance: Incorporating the roles of learning and fixed assets', *Journal of Operations Management*. Elsevier B.V., 29(7–8), pp. 677–691. doi: 10.1016/j.jom.2011.03.002.

Jamieson, V. (2017a) *Bournemouth University Selects D2L's Brightspace to Transform Learning for Its 18,000+ Students | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/bournemouth-university-selects-d2ls-brightspace-transform-learning-18000-students/ (Accessed: 2 September 2018).

Jamieson, V. (2017b) *Southern New Hampshire University Selects D2L's Brightspace as Its New Learning Management System | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/southern-new-hampshire-university-selects-d2ls-brightspace-new-learning-management-system/ (Accessed: 3 September 2018).

Jamieson, V. (2017c) *The University of Derby Selects D2L's Brightspace VLE for Its Modern Design, Personalised Learning and Analytics Capabilities | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/university-derby-selects-d2ls-brightspace-vle-modern-design-personalised-learning-analytics-capabilities/ (Accessed: 25 February 2018).

Jamieson, V. (2017d) *The University of Derby Selects D2L's Brightspace VLE for Its Modern Design, Personalised Learning and Analytics Capabilities | Press Release | D2L*. Available

at: https://www.d2l.com/newsroom/releases/university-derby-selects-d2ls-brightspace-vle-modern-design-personalised-learning-analytics-capabilities/ (Accessed: 2 September 2018).

Jobst, J. (2011) *Project Report and Recommendations*. Austin.

Joshi, A. W. (2016) 'When Does Customer Orientation Hinder (Help) Radical Product Innovation? the Role of Organizational Rewards', *Journal of Product Innovation Management*. doi: 10.1111/jpim.12301.

Justin (2015a) *Canvas Learning Management System — LISTedTECH*. Available at: https://www.listedtech.com/blog/canvas-learning-management-system?rq=Canvas (Accessed: 11 January 2019).

Justin (2015b) *Top HigherEd LMS vendors and the company's client base — LISTedTECH*. Available at: https://www.listedtech.com/listedtech/top-highered-lms-vendors-and-the-companys-client-base?rq=LMS (Accessed: 6 January 2019).

Justin (2015c) *WebCT and How it Helped Open Source LMS - LISTedTECH*. Available at: http://listedtech.com/webct-and-how-it-helped-open-source/ (Accessed: 22 August 2018).

Kammerlander, N., König, A. and Richards, M. (2018) 'Why Do Incumbents Respond Heterogeneously to Disruptive Innovations? The Interplay of Domain Identity and Role Identity', *Journal of Management Studies*, 55(7), pp. 1122–1165. doi: 10.1111/joms.12345.

Kaplan, S. and Henderson, R. (2005) 'Inertia and Incentives: Bridging Organizational Economics and Organizational Theory', *Organization Science*, 16(5), pp. 509–521. doi: 10.1287/orsc.1050.0154.

Kaplan, S. and Tripsas, M. (2008) 'Thinking about technology: Applying a cognitive lens to technical change', *Research Policy*, 37(5), pp. 790–805. doi: 10.1016/j.respol.2008.02.002.

Karpowicz, J. (2017) *Deploying Drones on a Massive Scale: An Interview with PrecisionHawk CEO Michael Chasen - Commercial UAV News*. Available at: https://www.expouav.com/news/latest/deploying-drones-massive-scale-interview-precisionhawk-ceo-michael-chasen/ (Accessed: 14 September 2018).

Kats, Y. . b (2010) *Learning management system technologies and software solutions for online teaching: Tools and applications*, *Learning Management System Technologies and Software Solutions for Online Teaching: Tools and Applications*. doi: 10.4018/978-1-61520-853-1.

Kavelman, D. (2012) *Former RIM executive joins tech startup Desire2Learn - The Globe and Mail*. Available at: https://www.theglobeandmail.com/technology/tech-news/former-rim-executive-joins-tech-startup-desire2learn/article1360301/ (Accessed: 10 March 2018).

Kelly, S. (2009) *The Problem with Blackboard 9 - HackCollege*. Available at: https://www.hackcollege.com/blog/2009/10/19/the-problem-with-blackboard-9.html (Accessed: 13 June 2018).

Kempfert, T. (2003) 'UW Selects Desire2Learn as its New e-learning system', *Teaching With Technology Today*.

Kessler, E. H. and Chakrabarti, A. K. (1996) 'Innovation Speed: A Conceptual Model of Context, Antecedents, and Outcomes', *The Academy of Management Review*, 21(4), p. 1143. doi: 10.2307/259167.

Kim, J. (2011) *Instructure Canvas Has Some Buzz | Technology and Learning*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/blogs/technology-and-learning/instructure-canvas-has-some-buzz (Accessed: 13 July 2018).

Kim, T. (2006) ‘Framing Interorganizational Network Change : A Network Inertia Perspective’, 31(3), pp. 704–720.

King, A. A. and Baatartogtokh, B. (2015) ‘How useful is the theory of disruptive innovation?’, *MITSloan Management Review*, 57(1), pp. 77–90. doi: 10.1017/CBO9781107415324.004.

Klenner, P., Hüsig, S. and Dowling, M. (2013) ‘Ex-ante evaluation of disruptive susceptibility in established value networks - When are markets ready for disruptive innovations?’, *Research Policy*. Elsevier B.V., 42(4), pp. 914–927. doi: 10.1016/j.respol.2012.12.006.

Knighton, D. (2013) *Instructure Announces Canvas App Center*. Available at: https://www.canvaslms.com/news/press-releases/instructure-announces-canvas-app-center (Accessed: 23 July 2018).

Knighton, D. and Reichman, M. (2014) *Instructure CEO Josh Coates Named EY Entrepreneur of the Year*. Available at: https://www.canvaslms.com/news/press-releases/instructure-ceo-josh-coates-named-ey-entrepreneur-of-the-year (Accessed: 23 July 2018).

Kolowich, S. (2012a) *Blackboard’s Open-Source Pivot*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/news/2012/03/27/blackboard-buys-moodlerooms-creates-open-source-division (Accessed: 13 July 2018).

Kolowich, S. (2012b) *Blackboard buys Moodlerooms, creates open-source division*. Available at: http://www.insidehighered.com/news/2012/03/27/blackboard-buys-moodlerooms-creates-open-source-division (Accessed: 13 March 2018).

Kolowich, S. (2012c) *What does the LMS of the future look like?*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/news/2012/01/11/what-does-lms-future-look (Accessed: 23 July 2018).

Lalande, N. and Grewal, R. (2012) 'Blackboard vs. Desire2Learn: A system administrator's perspective on usability', *2012 International Conference on Education and e-Learning Innovations, ICEELI 2012*. IEEE, pp. 1–4. doi: 10.1109/ICEELI.2012.6360587.

Lamore, P. R., Berkowitz, D. and Farrington, P. a. (2013) 'Proactive/Responsive Market Orientation and Marketing-Research and Development Integration', *Journal of Product Innovation Management*, 30(4), pp. 695–711. doi: 10.1111/jpim.12024.

Langerak, F. and Jan Hultink, E. (2006) 'The Impact of Product Innovativeness on the Link between Development Speed and New Product Profitability*', *Journal of Product Innovation Management*, 23(3), pp. 203–214. doi: 10.1111/j.1540-5885.2006.00194.x.

Lapowsky, I. (2015a) *The Reeducation of Blackboard, Everyone's Classroom Pariah*, *Wired*. Available at: https://www.wired.com/2015/07/blackboard-reinvention/ (Accessed: 21 July 2018).

Lapowsky, I. (2015b) *The Reeducation of Blackboard, Everyone's Classroom Pariah | WIRED*. Available at: https://www.wired.com/2015/07/blackboard-reinvention/ (Accessed: 28 August 2018).

Lardinois, F. (2012) *Online Education Platform Desire2Learn Raises Massive $80M Round From NEA & OMERS Ventures | TechCrunch*. Available at: https://beta.techcrunch.com/2012/09/04/online-education-platform-desire2learn-raises-massive-80m-round-from-nea-omers-ventures/ (Accessed: 5 March 2018).

Learning Management Evaluation Committee (2016) *Recommendation to Adopt the Canvas Learning Management System for UNC Charlotte*. Charlotte. Available at: https://teaching.uncc.edu/sites/teaching.uncc.edu/files/media/files/LMSEval/FinalReportofthe LearningManagementSystemEvaluationCommitteeMarch2016.pdf (Accessed: 15 July 2018).

Lederman, D. (2012) *Open-Source Leaders Who Backed Blackboard's Moodle Move Reassure Advocates*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/quicktakes/2012/03/28/open-source-leaders-who-backed-blackboards-moodle-move-reassure-advocates (Accessed: 19 July 2018).

Lederman, D. (2017) *The Learning Management Landscape*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/digital-learning/article/2017/05/17/where-trends-are-going-lms-market (Accessed: 12 July 2018).

Lee, a. H. I., Chen, H. H. and Tong, Y. (2008) 'Developing new products in a network with efficiency and innovation', *International Journal of Production Research*, 46(17), pp. 4687–4707. doi: 10.1080/00207540701233484.

Leek, S. and Kun, D. (2006) 'Consumer confusion in the Chinese personal computer market', *Journal of Product & Brand Management*, 15(3), pp. 184–193. doi: 10.1108/10610420610668621.

Leonard-Barton, D. (1992) 'Core capabilities and core rigidities: A paradox in managing new product development', *Strategic Management Journal*. doi: 10.1002/smj.4250131009.

Licamele, G. (2002a) *GW's Prometheus Merges with Software Developer Blackboard Inc.*, *By Gorge! Online*. Available at: https://www2.gwu.edu/~bygeorge/march7ByG!/prometheus.html (Accessed: 28 April 2018).

Licamele, G. (2002b) *GW's Prometheus Merges with Software Developer Blackboard Inc.*, *BY GEORGE! Online*. Available at: https://www2.gwu.edu/~bygeorge/march7ByG!/prometheus.html (Accessed: 20 August 2018).

Lieberman, M. (2017) *'Wait and See'' at Blackboard'*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/digital-learning/article/2017/09/20/blackboard-gaining-back-some-ground-observers-are-cautious (Accessed: 12 July 2018).

Lieberman, M. (2018) *Moodle and Blackboard part ways amid shifting LMS landscape*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/digital-learning/article/2018/08/01/moodle-and-blackboard-part-ways-amid-shifting-lms-landscape (Accessed: 29 August 2018).

ListedTech (2018) *Contrasting LMS Adoption Patterns in Four English-Speaking Countries — LISTedTECH*. Available at: https://www.listedtech.com/blog/contrasting-lms-adoption-patterns-in-four-english-speaking-countries?rq= LMS (Accessed: 4 May 2019).

LISTedTECH (2016) *LMS Pilots as Lead Indicators of Market Movements - LISTedTECH*. Available at: http://listedtech.com/canvas-pilot/ (Accessed: 16 March 2018).

LISTedTECH (2017) *What Percentage of HigherEd Institutions have a LMS? - LISTedTECH*. Available at: http://listedtech.com/percent-highered-institutions-lms/ (Accessed: 11 March 2018).

*LMS Data – Spring 2017 Updates* (2017) *edutechnica*. Available at: https://edutechnica.com/2017/03/12/lms-data-spring-2017-updates/ (Accessed: 27 June 2018).

LMS Evaluation project team (2016) *Reports | Desire2Learn to Canvas Migration | University of Colorado Boulder*. Available at: https://www.colorado.edu/lms/lms-evaluation/reports (Accessed: 7 March 2018).

Loffe, Y. (2015) *Q&A With Martin Dougiamas, Founder and CEO of Moodle*, *edtechtimes*. Available at: https://edtechtimes.com/2015/01/29/qa-martin-dougiamas-founder-ceo-moodle/ (Accessed: 5 July 2018).

Lukas, B. A. *et al.* (2013) 'Why Do Customers Get More Than They Need? How Organizational Culture Shapes Product Capability Decisions', 77(January), pp. 1–12.

Lunden, I. and Empson, R. (2013) *Flush With $80M, Desire2Learn Buys 'Anti-Sharepoint For Students' Platform Wiggio, Its 2nd Acquisition In 2 Months | TechCrunch*. Available at: https://beta.techcrunch.com/2013/03/08/flush-with-80m-desire2learn-buys-anti-sharepoint-for-students-platform-wiggio-its-2nd-acquisition-in-2-months/ (Accessed: 5 March 2018).

Luthra, S. (2011) *Canvas slated to replace MyCourses*, *The Brown Daily Herald*. Available at: http://www.browndailyherald.com/2011/09/25/canvas-slated-to-replace-mycourses/ (Accessed: 7 June 2018).

Machado, M. and Tao, E. (2007) 'Session S4J Blackboard vs. Moodle: Comparing User Experience of Learning Management Systems', in *37th ASEE/IEEE Frontiers in Education Conference*. Milwaukee: IEEE, pp. 7–12. Available at: http://fie2012.fie-conference.org/sites/fie2012.fie-conference.org/history/fie2007/papers/1194.pdf (Accessed: 15 July 2018).

Manion, M. T. and Cherion, J. (2009) 'Impact of strategic type on success measures for product development projects', *Journal of Product Innovation Management*, 26(1), pp. 71–85. doi: 10.1111/j.1540-5885.2009.00335.x.

Markides, C. (2006b) ‘Disruptive innovation: In need of better theory’, *Journal of Product Innovation Management*, pp. 19–25. doi: 10.1111/j.1540-5885.2005.00177.x.

Markides, C. and Charitou, C. D. (2004) ‘Competing with dual business models: A contingency approach.’, *Academy of Management Executive*, 18(3), pp. 22–36. doi: 10.5465/AME.2004.14776164.

Marksbury, N., Zhang, Q. and Post, C. W. (2009) *A Pilot Study of CMS Usability Testing: Blackboard and Moodle*. Available at: http://www.nlm.me/pubs/cmsstudy.pdf (Accessed: 16 July 2018).

McCarthy, I. P. *et al.* (2006) ‘New Product Development as a Complex Adaptive System of Decisions’, *Journal of Product Innovation Management*, 23(5), pp. 437–456. doi: 10.1111/j.1540-5885.2006.00215.x.

McKenzie, L. (2018) *Canvas catches, and maybe passes, Blackboard as top learning management system for U.S. colleges*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/digital-learning/article/2018/07/10/canvas-catches-and-maybe-passes-blackboard-top-learning (Accessed: 12 July 2018).

McLeod, J. (2011) *University of Colorado at Boulder Migrates to Desire2Learn Learning Suite | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/university-of-colorado-at-boulder-migrates-to-desire2learn-learning-suite/ (Accessed: 7 March 2018).

McNally, R. C., Akdeniz, M. B. and Calantone, R. J. (2011) ‘New Product Development Processes and New Product Profitability: Exploring the Mediating Role of Speed to Market and Product Quality’, *Journal of Product Innovation Management*, 28(s1), pp. 63–77. doi: 10.1111/j.1540-5885.2011.00861.x.

McNally, R. C., Cavusgil, E. and Calantone, R. J. (2010) 'Product Innovativeness Dimensions and Their Relationships with Product Advantage, Product Financial Performance, and Project Protocol', *Journal of Product Innovation Management*, 27(7), pp. 991–1006. doi: 10.1111/j.1540-5885.2010.00766.x.

Methodist, S. (1986) 'The Dominant Logic : a New Linkage Between Diversity and Performance', 7(April 1985), pp. 485–501.

Meyer, C. (no date) *Rose State College Migrating from WebCT Campus Edition 4.1 to Desire2Learn*, *2008*. Available at: http://my.rose.edu/d2l/okd2l/SWOSU-Rose_D2L_Case_Study.pdf (Accessed: 11 March 2018).

Michael, F. (2013) *Desire2Learn Analytics Follow-up*. Available at: https://mfeldstein.com/desire2learn-analytics-follow-up/ (Accessed: 15 March 2018).

Miles, M. B. and Huberman, A. M. (1994) *Qualitative Data Analysis*, *An expanded sourcebook*. doi: 10.1080/0140528790010406.

Miller, D. (1993) 'The Architecture of Simplicity', *The Academy of Management Review*, 18(1), p. 116. doi: 10.2307/258825.

Minnesota University (2017) *University of Minnesota Learning Management System (LMS) Review-2017 Report*. Minneapolis. Available at: https://it.umn.edu/sites/it.umn.edu/files/umnlmsreview.docx.pdf (Accessed: 15 July 2018).

Mitchell, V.-W. and Papavassiliou, V. (1999) 'Marketing causes and implications of consumer confusion', *Journal of Product & Brand Management*, 8(4), pp. 319–342. doi: 10.1108/10610429910284300.

Mitchell, V. (2005) 'Towards a Conceptual Model of Consumer Confusion', 32.

Moodle Pty Led (2017) *History - MoodleDocs*, *Moodle Offical Website*. Available at: https://docs.moodle.org/34/en/History (Accessed: 8 July 2018).

Moody, J. (2018) *Canvas Chases Blackboard Learn For Lead LMS Spot*, *Forbes*. Available at: https://www.forbes.com/sites/joshmoody/2018/07/14/canvas-chases-blackboard-learn-for-lead-lms-spot/#4ac7849559bc (Accessed: 30 August 2018).

Moon, Y. (2005) 'Break free from the product life cycle.', *Harvard Business Review*. Available at: http://europepmc.org/abstract/MED/15929406 (Accessed: 30 April 2014).

Moreau, S. (2006) *Oklahoma State University Teams with Desire2Learn | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/oklahoma-state-university-teams-with-desire2learn/ (Accessed: 20 March 2018).

Morrill, J. H. *et al.* (2015) *UW-Madison Canvas Pilot Evaluation-Spring 2015*. Madison. Available at: http://lmsevaluation.teachou.net/wp-content/uploads/2016/02/100815-UW-Madison-Canvas-Pilot-Evaluation-Spring-2015.pdf (Accessed: 16 July 2018).

Nagel, D. (2009) *Blackboard To Buy Out Angel Learning -- Campus Technology*. Available at: https://campustechnology.com/articles/2009/05/06/blackboard-to-buy-out-angel-learning.aspx (Accessed: 20 August 2018).

Nagy, D., Schuessler, J. and Dubinsky, A. (2016) 'Defining and identifying disruptive innovations', *Industrial Marketing Management*, 57, pp. 119–126. doi: 10.1016/j.indmarman.2015.11.017.

Narver, J. C., Slater, S. F. and MacLachlan, D. L. (2004) 'Responsive and Proactive Market Orientation and New Product Success', *Journal of Product Innovation Management*, 21(5), pp. 334–347. doi: 10.1111/j.0737-6782.2004.00086.x.

Negro, G., Hannan, M. and Fassiotto, M. A. (2015) 'Category Signaling: Biodynamic and Organic Winemaking in Alsace', *Organization Science*, 26(2), pp. 584–600.

Noda, T. and Bower, J. L. (2007) 'Strategy making as iterated processes of resource allocation', *Strategic Management Journal*, 17(S1), pp. 159–192. doi: 10.1002/smj.4250171011.

O'Connor, G. C. and Rice, M. P. (2013) 'A Comprehensive Model of Uncertainty Associated with Radical Innovation', *Journal of Product Innovation Management*, 30, pp. 2–18. doi: 10.1111/jpim.12060.

O'Neil, M. (2014) *Blackboard Buys Student-Centric Web Platform MyEdu – Wired Campus - Blogs - The Chronicle of Higher Education*. Available at: https://www.chronicle.com/blogs/wiredcampus/blackboard-buys-student-centric-web-platform-myedu/49371 (Accessed: 1 September 2018).

O'Reilly, C. A. and Tushman, M. L. (2008) 'Ambidexterity as a dynamic capability: Resolving the innovator's dilemma', *Research in Organizational Behavior*, (28), pp. 185–206. doi: 10.1016/j.riob.2008.06.002.

Office of Distance Education and elearning (2015) *Autumn 2015 Canvas Pilot Survey Results*. Columbus. Available at: http://lmsevaluation.teachou.net/wp-content/uploads/2016/03/OhioState_autumn_15_canvas_pilot_survey_results.pdf (Accessed: 16 July 2018).

Oklahoma University (2016a) *Recommendation – Learning Management System Evaluation*. Available at: http://lmsevaluation.teachou.net/recommendation/ (Accessed: 7 March 2018).

Oklahoma University (2016b) *Recommendation – Learning Management System Evaluation*. Available at: http://lmsevaluation.teachou.net/recommendation/ (Accessed: 15 March 2018).

Olson, E. M., Slater, S. F. and Hult, G. T. M. (2005) 'The Performance Implications of Fit Among Business Strategy , Marketing Organization Structure , and Strategic', 69(July), pp. 49–65.

Van Orden, J., van der Rhee, B. and Schmidt, G. M. (2011) 'Encroachment Patterns of the "Best Products" from the Last Decade*', *Journal of Product Innovation Management*, p. no-no. doi: 10.1111/j.1540-5885.2011.00834.x.

Overly, S. (2014) *Under new strategy, Blackboard acquires yet another firm - The Washington Post*. Available at: http://cc.bingj.com/cache.aspx?q=Under+new+strategy%2C+Blackboard+acquires+yet+another+firm&d=4732703539664048&mkt=en-US&setlang=en-US&w=rjcLo6D54LloLzucFhh8B37XsI54L3ji (Accessed: 29 August 2018).

Ozcan, P., Han, S. and Graebner, M. E. (2017) 'Single cases: the what, why, and how', in *The Routledge Companion to Qualitative Research in Organization Studies*. New York: Routledge, pp. 92–112. Available at: http://pinarozcan.com/wp-content/uploads/2018/07/Ozcan-et-al-Single-Case-Chapter-2017-Pre-edit.pdf.

Parry, M. E. and Kawakami, T. (2017) 'The Encroachment Speed of Potentially Disruptive Innovations with Indirect Network Externalities: The Case of E-Readers', *Journal of Product Innovation Management*, 34(2), pp. 141–158. doi: 10.1111/jpim.12333.

Pearistein, S. (2012) *Blackboard's departing founder, an opportunist who made his own luck - The Washington Post*, *The Washington Post*. Available at: https://www.washingtonpost.com/business/blackboards-departing-founder-an-opportunist-who-made-his-own-luck/2012/11/17/0663816e-2f7f-11e2-9f50-

0308e1e75445_story.html?noredirect=on&utm_term=.5922576f7c00 (Accessed: 5 May 2018).

Penn State Information Technology Services and Outreach and Online Education (2015) *Canvas Pilot Spring 2015: Summary of End-Term Survey Results*. Available at: http://webaim.org/services/certification/canvas (Accessed: 1 August 2018).

Pettigrew, A. M. (1990) 'Longitudinal Field Research on Change: Theory and Practice', *Organization Science*, 1, pp. 267–292. doi: 10.1287/orsc.1.3.267.

Pfeifer-Lukett, R. (2015a) *Instructure Canvas Pilot II ( 2015 ) Report Attachments*. Available at: https://www.wisconsin.edu/systemwide-it/download/it-projects/canvas-ii/Instructure-Canvas-Pilot-II-Results-Summary-final.pdf.

Pfeifer-Lukett, R. (2015b) *UW System Canvas Pilot II Results Memo*. Available at: https://www.wisconsin.edu/systemwide-it/download/it-projects/canvas-ii/Canvas-Pilot-II-Results-Memo-final.pdf.

Pfeifer-Lukett, R. (2016) *Student Experience with D2L and other LMSs*. Available at: https://www.colorado.edu/lms/sites/default/files/attached-files/lms_eval-stud_1.pdf.

Pittinsky, M. and Gilfus, S. (2000) 'Blackboard Product Strategy & Vision White Paper on Building Blocks (B 2 ) Initiative', 2000. Available at: http://www.blackboard.com.

Porter, M. E. (1996) 'What is Strategy?', *Harvard Business Review*, 74, pp. 61–78. doi: 10.1098/rspb.2008.0355.

Poulova, P., Simonova, I. and Manenova, M. (2015) 'Which One, or Another? Comparative Analysis of Selected LMS', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 186, pp. 1302–1308. doi: 10.1016/j.sbspro.2015.04.052.

Powell, J. and Lin, L. (2011) *Moodle-A Brief Overview*. Available at: http://docs.moodle.org/dev/Releases (Accessed: 8 July 2018).

Punch, K. F. (2005) *Introduction to Social Research: Quantitative and Qualitative Approaches*, *Introduction to social research quantitative and qualitative approaches*. Available at: http://books.google.com/books?id=OvzPabc83HoC&pgis=1.

de Raadt, M. (2012) *How Moodle gets from HQ to you (and how you can help too)*, *SALVETORE The blog of Michael de Raadt*. Available at: https://salvetore.wordpress.com/2012/03/16/how-moodle-gets-from-hq-to-you-and-how-you-can-help-too/ (Accessed: 6 July 2018).

Raadt, M. de (2012) *Moodle is Mainstream | salvetore*, *The blog of Michael de Raadt*. Available at: https://salvetore.wordpress.com/2012/07/14/moodle-is-mainstream/ (Accessed: 2 July 2018).

Raffaelli, R. (2018) 'Technology Reemergence: Creating New Value for Old Technologies in Swiss Mechanical Watchmaking, 1970-2008', *Administrative Science Quarterly*, pp. 1–43. doi: 10.1177/0001839218778505.

Ragnetti, A. (2011) *Apple's Competitive Advantage*, *The Huffington Post*. Available at: http://www.huffingtonpost.co.uk/andrea-ragnetti/apples-competitive-advant_b_936215.html (Accessed: 12 November 2014).

Ramos, L. (2016a) *Canvas Evaluation*. Available at: https://odee.osu.edu/news/2016/03/08/canvas-evaluation (Accessed: 15 March 2018).

Ramos, L. (2016b) *Canvas Evaluation | Office of Distance Education and eLearning*. Available at: https://odee.osu.edu/news/2016/03/08/canvas-evaluation (Accessed: 10 March 2018).

Randall, B., Sweetin, J. and Steinbeiser, D. (2009) *Open Source Collaborative: Moodle Assessment Report*. Raleigh. Available at: https://oscmoodlereport.files.wordpress.com/2009/08/osc_full_report.pdf (Accessed: 6 July 2018).

Rebecca, M. and Kim, B. (1990) 'Architectural Innovation : The Reconfiguration Of Existing'.

Redding, S. (2002) 'Path dependence, endogenous innovation, and growth', *International Economic Review*, 43, pp. 1215–1248. doi: 10.1111/1468-2354.t01-1-00054.

Reid, S. E. and De Brentani, U. (2004) 'The fuzzy front end of new product development for discontinuous innovations: A theoretical model', in *Journal of Product Innovation Management*, pp. 170–184. doi: 10.1111/j.0737-6782.2004.00068.x.

Reinhardt, R. and Gurtner, S. (2018) 'The overlooked role of embeddedness in disruptive innovation theory', *Technological Forecasting and Social Change*. Elsevier, 132(February 2017), pp. 268–283. doi: 10.1016/j.techfore.2018.02.011.

Reinhart, A. (2012a) *D2L's John Baker: Desire to make a difference | Communitech News*. Available at: http://news.communitech.ca/d2ls-john-baker-desire-to-make-a-difference/ (Accessed: 26 September 2018).

Reinhart, A. (2012b) *D2L's John Baker: Desire to make a difference | Communitech News*. Available at: http://news.communitech.ca/d2ls-john-baker-desire-to-make-a-difference/ (Accessed: 13 August 2018).

Reinhart, A. (2012c) *Q+A with John Baker on Desire2Learn's $80M VC round | Communitech News*. Available at: http://news.communitech.ca/john-baker-comments-on-desire2learn-80-million-vc-round/ (Accessed: 10 August 2018).

Reinhart, A. (2014) *D2L 'just getting warmed up' with $85M Series B round: Baker | Communitech News*. Available at: http://news.communitech.ca/d2l-just-getting-warmed-up-with-85m-series-b-round-baker/ (Accessed: 26 September 2018).

Rhee, B., Schmidt, G. M. and Van Orden, J. (2012) 'High-end Encroachment Patterns of New Products', *Journal of Product Innovation Management*, 29(5), pp. 715–733. doi: 10.1111/j.1540-5885.2012.00945.x.

Riddell, R. (2013) *Behind the scenes at Blackboard: How educator feedback matters more than ever | Education Dive*. Available at: https://www.educationdive.com/news/behind-the-scenes-at-blackboard-how-educator-feedback-matters-more-than-ev/204990/ (Accessed: 13 August 2018).

Rijsdijk, Serge A, Langerak, F. and Jan Hultink, E. (2011) 'Understanding a two-sided coin: Antecedents and consequences of a decomposed product advantage', *Journal of Product Innovation Management*, 28(1), pp. 33–47. doi: 10.1111/j.1540-5885.2010.00779.x.

Rijsdijk, Serge A., Langerak, F. and Jan Hultink, E. (2011) 'Understanding a two-sided coin: Antecedents and consequences of a decomposed product advantage', *Journal of Product Innovation Management*, 28(1), pp. 33–47. doi: 10.1111/j.1540-5885.2010.00779.x.

Rogers, B. (2014) *John Baker's Desire2Learn Is Leading Education Transformation*. Available at: https://www.forbes.com/sites/brucerogers/2014/04/23/john-bakers-desire2learn-is-leading-education-transformation/#4380e5e03ff0 (Accessed: 8 March 2018).

Rosenbloom, R. S. and Christensen, C. M. (1994) 'Technological discontinuties, organizational capabilities, and strategic commitments', *Industrial and Corporate Change*. doi: 10.1093/icc/3.3.655.

Rothaermel, F. T. (2001) 'Incumbent's advantage through exploiting complementary assets via interfirm cooperation', *Strategic Management Journal*, 22, pp. 687–699. doi: 10.1002/smj.180.

Roy, R. and Cohen, S. K. (2017) 'Stock of downstream complementary assets as a catalyst for product innovation during technological change in the U.S. machine tool industry', *Strategic Management Journal*, 38, pp. 1253–1267.

Roy, R. and Sarkar, M. (2016) 'Knowledge, firm boundaries, and innovation: Mitigating the incumbent's curse during radical technological change', *Strategic Management Journal*, 37, pp. 835–854.

Ruan, Y., Hang, C. C. and Wang, Y. M. (2014) 'Government's role in disruptive innovation and industry emergence: The case of the electric bike in China', *Technovation*. doi: 10.1016/j.technovation.2014.09.003.

Sakoda, J. and Viswanathan, R. (2012) *Desire2Learn: Leading the Renaissance in Education | NEA | New Enterprise Associates*. Available at: http://www.nea.com/blog/desire2learn-leading-the-renaissance-in-education (Accessed: 15 March 2018).

Salomo, S., Gemünden, H. G. and Leifer, R. (2007) 'Research on corporate radical innovation systems—A dynamic capabilities perspective: An introduction', *Journal of Engineering and Technology Management*, 24(1–2), pp. 1–10. doi: 10.1016/j.jengtecman.2007.01.001.

Sanchez, R. (1995) 'Strategic flexibility in product competition', *Strategic Management Journal*, 16(S1), pp. 135–159. doi: 10.1002/smj.4250160921.

Saunders, M., Lewis, P. and Thornhill, A. (2012) *Research Methods for Business Students*, *Research methods for business students*.

Schaffhauser, D. (2010a) *McMaster U To Move to Desire2Learn after Blackboard Outages -- Campus Technology*. Available at: https://campustechnology.com/Articles/2010/05/03/McMaster-U-To-Move-to-Desire2Learn-after-Blackboard-Outages.aspx?Page=1 (Accessed: 7 March 2018).

Schaffhauser, D. (2010b) *McMaster U To Move to Desire2Learn after Blackboard Outages -- Campus Technology*. Available at: https://campustechnology.com/articles/2010/05/03/mcmaster-u-to-move-to-desire2learn-after-blackboard-outages.aspx (Accessed: 7 March 2018).

Schaffhauser, D. (2011) *UK's U Surrey Chooses Desire2Learn*. Available at: https://campustechnology.com/articles/2011/10/20/uks-u-surrey-chooses-desire2learn.aspx (Accessed: 13 March 2018).

Schaffhauser, D. (2016) *Blackboard Releases "Ultra Experience" -- Campus Technology*. Available at: https://campustechnology.com/articles/2016/07/12/blackboard-releases-ultra-experience.aspx (Accessed: 31 August 2018).

Schaffler, R. (2015) *Instructure (INST) IPO Debuts on NYSE With Double-Digit Gain*, *TheStreet*. Available at: https://www.thestreet.com/story/13365356/1/instructure-ipo-debuts-on-nyse-with-double-digit-gain.html (Accessed: 22 July 2018).

Schmidt, G. M. and Druehl, C. T. (2008a) 'When Is a Disruptive Innovation Disruptive?', (2003), pp. 347–369.

Schmidt, G. M. and Druehl, C. T. (2008b) 'When Is a Disruptive Innovation Disruptive.pdf', (2003), pp. 347–369.

Schreyogg, G. and Sydow, J. (2011) 'Organizational Path Dependence: A Process View', *Organization Studies*, 32(3), pp. 321–335. doi: 10.1177/0170840610397481.

Sclater, N. (2008) 'Enhancing Moodle to Meet the Needs of 200,000 distance learners', in *Silesian Moodle Moot*, pp. 1–7. Available at: http://handicap.vsb.cz/wiki/images/3/37/Niall Sclater SMM.pdf.

Seidel, V. P. (2007) 'Concept shifting and the radical product development process', *Journal of Product Innovation Management*, 24(6), pp. 522–533. doi: 10.1111/j.1540-5885.2007.00269.x.

Sekaran, U., & Bougie, R. (2010) *Research method for business: A skill building approach, 5th edition*. 5th edn, *United States: John Wiley & Sons Inc.* 5th edn.

Siggelkow, N. (2001) 'Change in the presence of fit: the rise, the fall, and the renascence of Liz Clairborne', *Academy of Management Journal*, 44(4), pp. 838–857. doi: 10.2307/3069418.

Siggelkow, N. (2002) 'Evolution toward Fit', *Administrative Science Quarterly*, 47(1), p. 125. doi: 10.2307/3094893.

Siggelkow, N. (2007) 'Persuasion with Case Studies - Siggelkow - S1&2 R1.pdf', *Source: The Academy of Management Journal*, 50(1), pp. 20–24. doi: 10.5465/AMJ.2007.24160882.

Slater, S. F. and Mohr, J. J. (2006) 'Successful Development and Commercialization of Technological Innovation: Insights Based on Strategy Type', *Journal of Product Innovation Management*, 23(1), pp. 26–33. doi: 10.1111/j.1540-5885.2005.00178.x.

Slater, S. F., Mohr, J. J. and Sengupta, S. (2014) 'Radical Product Innovation Capability: Literature Review, Synthesis, and Illustrative Research Propositions', *Journal of Product Innovation Management*, 31(3), pp. 552–566. doi: 10.1111/jpim.12113.

Sobh, R. and Perry, C. (2006) ‘Research design and data analysis in realism research’, *European Journal of Marketing*, 40(11/12), pp. 1194–1209. doi: 10.1108/03090560610702777.

Sood, A. and Tellis, G. J. (2010) *Demystifying Disruption: A New Model for Understanding and Predicting Disruptive Technologies*, *SSRN*. doi: 10.2139/ssrn.1629493.

Srinivasan, R., Lilien, G. L. and Rangaswamy, A. (2006) ‘The Emergence of Dominant Design’, 70(April), pp. 1–17.

Stanko, M. a., Molina-Castillo, F.-J. and Munuera-Aleman, J.-L. (2012) ‘Speed to Market for Innovative Products: Blessing or Curse?’, *Journal of Product Innovation Management*, 29(5), pp. 751–765. doi: 10.1111/j.1540-5885.2012.00943.x.

Staw, B. M., Sandelands, L. E. and Dutton, J. E. (2015) ‘Threat-Rigidity Effects in Organizational Behavior : A Multilevel Analysis’, *Administrative Science Quarterly*, 26(4), pp. 501–524.

Stephen, G. (2000) *Blackboard Product Strategy and Development Roadmap*.

Sterman, J. D. *et al.* (2007) ‘Getting Big Too Fast: Strategic Dynamics with Increasing Returns and Bounded Rationality’, *Management Science*, 53(4), pp. 683–696. doi: 10.1287/mnsc.1060.0673.

Straumsheim, C. (2014a) *Blackboard Acquires Videoconferencing Software Provider*, *INSIDE HIGHER ED* . Available at: https://www.insidehighered.com/quicktakes/2014/09/25/blackboard-acquires-videoconferencing-software-provider (Accessed: 13 July 2018).

Straumsheim, C. (2014b) *Facing end-of-life status, institutions running Angel look for new LMS providers*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/news/2014/10/28/facing-end-life-status-institutions-running-angel-look-new-lms-providers (Accessed: 13 July 2018).

Straumsheim, C. (2014c) *Moodle tops Blackboard among small colleges, analysis says*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/news/2014/02/13/moodle-tops-blackboard-among-small-colleges-analysis-says (Accessed: 9 July 2018).

Straumsheim, C. (2017) *Blackboard's all-of-the-above strategy*, *INSIDE HIGHER ED*. Available at: https://www.insidehighered.com/news/2017/04/25/analysts-colleges-question-blackboards-all-above-strategy (Accessed: 12 July 2018).

Strauss, A. and Corbin, J. (1998) 'Grounded Theory Methodology: AN Overview', in *Handbook of qualitative research*. doi: 10.1007/BF00988593.

Strauss, A. L. and Corbin, J. M. (1990) *Basics of Qualitative Research: grounded theory procedures and techniques*, *Basics of Qualitative Research: grounded theory procedures and techniques*. Newbury Park, CA: Sage. doi: 10.4135/9781452230153.

Suarez, F. F. *et al.* (2018) 'The Hybrid Trap: Why Most Efforts to Bridge Old and New Technology Miss the Mark', *Sloan Management Review*.

Suarez, F. and Lanzolla, G. (2005) 'The half-truth of first-mover advantage.', *Harvard Business Review*, 83(4), pp. 121–7, 134. Available at: http://www.ncbi.nlm.nih.gov/pubmed/15807045.

Swink, M., Talluri, S. and Pandejpong, T. (2006) ‘Faster, better, cheaper: A study of NPD project efficiency and performance tradeoffs’, *Journal of Operations Management*, 24(5), pp. 542–562. doi: 10.1016/j.jom.2005.09.004.

Sydow, J., Schreyögg, G. and Koch, J. (2009) ‘Organizational Path Dependence: Opening the Black Box.’, *Academy of Management Review*, 34(4), pp. 689–709. doi: 10.5465/AMR.2009.44885978.

Tate, E. (2018) *How Canvas came to unseat Blackboard as the leading LMS*, *edscoop*. Available at: https://edscoop.com/how-canvas-came-to-unseat-blackboard-as-the-leading-lms/ (Accessed: 6 January 2019).

Technology Evaluation Subcommittee (2016) *Learning Management System Recommendation For Mizzou*. Columbia. Available at: http://lmsevaluation.teachou.net/wp-content/uploads/2016/02/Mizzou-LMS-Pilot.pdf (Accessed: 16 July 2018).

Tegarden, L. F. (2013) ‘Doomed from the start : what is the value a future dominant design ? of selecting’, *Strategic Management.*, 20(6), pp. 495–518. Available at: http://onlinelibrary.wiley.com/doi/10.1002/(SICI)1097-0266(199906)20:6%3C495::AID-SMJ43%3E3.0.CO;2-M/abstract (Accessed: 29 April 2014).

Tellis, G. J. (2006) ‘Disruptive technology or visionary leadership?’, *Journal of Product Innovation Management*, 23(1), pp. 34–38. doi: 10.1111/j.1540-5885.2005.00179.x.

Temple University LMS Selection Committee (2017) *Learning Management System Evaluation Report*. Cecil B. Moore. Available at: https://computerservices.temple.edu/sites/computerservices/files/imce/LMS_Evaluation_Report.pdf (Accessed: 17 July 2018).

The Entrepreneur Center@NVTC (2005) *An Interview with Michael Chasen, Co-Founder and CEO, Blackboard, Inc.*, *Entrepreneur Weekly*. Available at: https://web.archive.org/web/20130615020955/http://www.nvtc.org/tec/MichaelChasen.php (Accessed: 8 August 2018).

Thompson, D. V., Hamilton, R. W. and Rust, R. T. (2005) 'Feature Fatigue : When Product Capabilities Become Too Much of a Good Thing', XLII(November), pp. 431–442.

Thrane, S., Blaabjerg, S. and Møller, R. H. (2010) 'Innovative path dependence: Making sense of product and service innovation in path dependent innovation processes', *Research Policy*, 39(7), pp. 932–944. doi: 10.1016/j.respol.2010.04.003.

Tidd, J. and Bessant, J. (2014) *Managing Innovation: Integrating Technolgoical, Market and Organizational Change*. 5th edn, *Wiley*. 5th edn. Chichester. doi: 10.1016/S0166-4972(98)80033-3.

Townsend, H. and Jamieson, V. (2018) *The University Of Suffolk Selects D2l'S Brightspace To Modernise Its Student Learning Experience*. Available at: https://globenewswire.com/news-release/2018/09/04/1565049/0/en/The-University-Of-Suffolk-Selects-D2l-S-Brightspace-To-Modernise-Its-Student-Learning-Experience.html (Accessed: 6 November 2018).

Tripathi, A. (2015) *Instructure Easy-to-Use LMS for Immersive Learning Experiences*, *Education Technology Insights*. Available at: https://www.educationtechnologyinsights.com/magazines/2015/Education-October/ (Accessed: 24 July 2018).

Tripsas, M. (1997) ‘Unraveling the Process of Creative Destruction: Complementary Assets and Incumbent Survival in the Typesetter Industry’, *Strategic Management Journal*, 18(S1), pp. 119–142. doi: 10.1002/(SICI)1097-0266(199707)18:1+<119::AID-SMJ921>3.3.CO;2-S.

Tripsas, M. and Gavetti, G. (2000) ‘Capabilities, cognition, and inertia: evidence from digital imaging’, *Strategic Management Journal*, 21(1011), pp. 1147–1161. doi: 10.1002/1097-0266(200010/11)21:10/11<1147::AID-SMJ128>3.3.CO;2-I.

Trott, P. (2008) *Innovation management and new product development*. 5th edn, *Prentice Hall*. 5th edn. Pearson Education. doi: 10.1111/j.1467-9310.2009.00551_1.x.

Trotter, A. (2008) *Education Week: Blackboard vs. Moodle Competition in course-management market grows*, *EDUCATION WEEK DIGITAL DIRECTIONS*. Available at: https://www.edweek.org/dd/articles/2008/06/09/01moodle.h02.html (Accessed: 31 May 2018).

Tushman, M. L. and A. O’Reilly III, C. (1997) ‘Winning Through Innovation: A Practical Guide to Leading Organizational Change and Renewal Revised Edition Edition’, *Strategy & Leadership*. doi: 10.1016/S0099-1333(97)90128-2.

Tynes, B. (2011) ‘Bye, bye Blackboard?’, *The Pendulum*, April, p. 3.

UITS Learning Technologies Functional Requirements Committee (2013) *IU LMS Pilots-A Comparative Functional Review*. Bloomington. Available at: https://confluence.sakaiproject.org/x/FgshB (Accessed: 27 July 2018).

Uni, Y. (2013) *Canvas Pilot | Center for Teaching and Learning*. Available at: https://ctl.yale.edu/using-technology/technology-pilots/canvas-pilot (Accessed: 7 March 2018).

University of Massachusetts, Amherst (2010) *Final Evaluation of Future LMS Options | Future LMS*, *UMassAmherst*. Available at: https://blogs.umass.edu/futurelms/2010/11/17/final-evaluation/#more-119 (Accessed: 15 July 2018).

University of Missouri (2015) *LEARNING MANAGEMENT SYSTEM RECOMMENDATION FOR MIZZOU*. Available at: http://lmsevaluation.teachou.net/wp-content/uploads/2016/02/Mizzou-LMS-Pilot.pdf (Accessed: 18 March 2018).

UNO Canvas Task Force (2017) *UNO Canvas Recommendation Report*. Omaha. Available at: https://www.unomaha.edu/information-technology-services/instructional-technology/canvas/_docs/canvas-recommendation.pdf (Accessed: 16 July 2018).

Uzunca, B., Rigtering, J. P. C. and Ozcan, P. (2018) 'Sharing and Shaping: A Cross-Country Comparison of How Sharing Economy Firms Shape Their Institutional Environment to Gain Legitimacy', *Academy of Management Discoveries*. doi: 10.5465/amd.2016.0153.

Vázquez Sampere, J. P., Bienenstock, M. J. and Zuckerman, E. W. (2016) 'Debating Disruptive Innovation', *MIT Sloan Management Review*, 57(3), pp. 26–27. Available at: http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=114181468&site=ehost-live.

Vecchiato, R. (2017) 'Disruptive innovation, managerial cognition, and technology competition outcomes', *Technological Forecasting and Social Change*. Elsevier Inc., 116, pp. 116–128. doi: 10.1016/j.techfore.2016.10.068.

Vergne, J.-P. and Durand, R. (2010) 'The Missing Link Between the Theory and Empirics of Path Dependence: Conceptual Clarification, Testability Issue, and Methodological

Implications', *Journal of Management Studies*, 47(4), pp. 736–759. doi: 10.1111/j.1467-6486.2009.00913.x.

Virginia, J. (2013) *Desire2Learn Acquires Knowillage Systems, Inc. | Press Release | D2L*. Available at: https://www.d2l.com/newsroom/releases/desire2learn-acquires-knowillage-systems-inc/ (Accessed: 15 March 2018).

Wan, F., Williamson, P. J. and Yin, E. (2015) 'Technovation Antecedents and implications of disruptive innovation : Evidence from China', *Technovation*. Elsevier, 39–40, pp. 94–104. doi: 10.1016/j.technovation.2014.05.012.

Wan, T. (2013) *Another Day, Another Acquisition for LMS Provider, Desire2Learn | EdSurge News*. Available at: https://www.edsurge.com/news/2013-09-09-another-day-another-acquisition-for-lms-provider-desire2learn (Accessed: 26 September 2018).

Wan, T. (2014a) *Desire2Learn's $85 Million Deal | EdSurge News*. Available at: https://www.edsurge.com/news/2014-08-13-desire2learn-s-85-million-deal (Accessed: 4 March 2018).

Wan, T. (2014b) *No Sugarcoating the LMS: Q&A with Instructure CEO, Josh Coates | EdSurge News*. Available at: https://www.edsurge.com/news/2014-09-30-no-sugarcoating-the-lms-q-a-with-instructure-ceo-josh-coates (Accessed: 23 August 2018).

Wan, T. (2014c) *The Sum of Desire2Learn's Acquisitions: Brightspace | EdSurge News*. Available at: https://www.edsurge.com/news/2014-07-14-the-sum-of-desire2learn-s-acquisitions-brightspace (Accessed: 14 August 2018).

Wan, T. (2017) *Why Moodle's Mastermind, Martin Dougiamas, Still Believes in Edtech After Two Decades | EdSurge News*. Available at: https://www.edsurge.com/news/2017-05-02-

why-moodle-s-mastermind-martin-dougiamas-still-believes-in-edtech-after-two-decades (Accessed: 2 July 2018).

Watkins, D. (2016) *Interview with Martin Dougiamas, Moodle's founder and lead developer | Opensource.com*. Available at: https://opensource.com/life/16/11/moodle-today (Accessed: 8 July 2018).

Weaver, B. (2008) *Wabash College: Moodle to Replace Blackboard at Wabash Crawfordsville, Indiana*. Available at: https://www.wabash.edu/technology/news.cfm?news_ID=5880 (Accessed: 15 July 2018).

Web, W. W. (1998) 'Comparing Course Authoring Software : WebCT vs . Blackboard'.

*WebCT - Wikipedia* (no date). Available at: https://en.wikipedia.org/wiki/WebCT#cite_note-7 (Accessed: 11 March 2018).

Wehr, J. (2003) *Blackboard buys Student Advantage's SA Cash unit for $4.5 million impacting 24 higher education customers - SecureIDNews*. Available at: https://www.secureidnews.com/news-item/blackboard-buys-student-advantages-sa-cash-unit-for-4-5-million-impacting-24-higher-education-customers/ (Accessed: 9 May 2018).

Wessel, M. and Christensen, C. (2012) 'Surviving disruption', *Harvard Business Review*, (December). Available at: http://www.pdf-archive.com/2012/12/21/survivingmaxwessel/survivingmaxwessel.pdf (Accessed: 29 April 2014).

Wheeler, H. and Mcleod, J. (2011) *University of Surrey to Implement Desire2Learn Learning Suite | Desire2Learn Press Release*. Available at: file:///Users/meaaron/Library/Mobile%2520Documents/com~apple~CloudDocs/USB/Methdology%2520%25E7%25A0%2594%25E7%25A9%25B6%25E6%2596%25B9%25E6%25B

3%2595/Datebase%2520%25E6%2595%25B0%25E6%258D%25AE%25E5%25BA%2593/desire2learn/University%2520of%2520Surrey%252 (Accessed: 6 March 2018).

Whitmer, B. (2010) *The Story of Instructure*, *The Other Brian Whitmer*. Available at: http://brianwhitmer.blogspot.com/2010/05/story-of-instructure.html (Accessed: 25 July 2018).

Whitmer, B. (2014) *On the Dangers of Prioritization*, *The Other Brian Whitmer*. Available at: http://brianwhitmer.blogspot.com/2014/11/on-dangers-of-prioritization.html (Accessed: 25 July 2018).

Whitmer, B. (2018) *Dear Instructure: Please Don't Become the Next Blackboard*, *The Other Brian Whitmer*. Available at: http://brianwhitmer.blogspot.com/ (Accessed: 25 July 2018).

Wong, L. (2013) 'Instructure Canvas Pilot Project Spring 2013 Final Report'.

Yin, R. K. (2009) *Case Study Research: Design and Methods*, *Essential guide to qualitative methods in organizational research*. doi: 10.1097/FCH.0b013e31822dda9e.

Yin, R. K. (2017) *Case study research and applications: Design and methods*. 6th edn. Sage Publications.

Young, J. R. (2013) *Blackboard May Double or Triple Spending on Software Development – Wired Campus - Blogs - The Chronicle of Higher Education*. Available at: https://www.chronicle.com/blogs/wiredcampus/blackboard-will-double-or-triple-spending-on-software-development/44743 (Accessed: 3 September 2018).

Yu, D. and Hang, C. C. (2010) 'A Reflective Review of Disruptive Innovation Theory', *International Journal of Management Reviews*. doi: 10.1111/j.1468-2370.2009.00272.x.

Yu, D. and Hang, C. C. (2011) 'Creating technology candidates for disruptive innovation: Generally applicable R & D strategies', *Technovation*. Elsevier, 31(8), pp. 401–410. doi: 10.1016/j.technovation.2011.02.006.

Zanjani, N. *et al.* (2017) 'The important elements of LMS design that affect user engagement with e-learning tools within LMSs in the higher education sector', *Australasian Journal of Educational Technology*, 33(1), pp. 19–31. doi: 10.14742/ajet.2938.

Zhang, Y. (2015) 'UKPDC 2015 PROCEEDINGS', in Onjewu, A. et al. (eds) *Antecedents and Consequences of Overshooting in the Context of Product Innovation*. Plymouth, UK: Plymouth University, p. pp.34-37.

Zinn, F. (2010) *Final Evaluation of Future LMS Options | Future LMS*. Available at: https://blogs.umass.edu/futurelms/2010/11/17/final-evaluation/#more-119 (Accessed: 15 July 2018).

# 8. Appendices

## 8.1. Interview Transcripts

**Interview Transcript (1)**

| | |
|---|---|
| **Interviewee:** | E-learning director from a Russel Group university in the UK |
| **Interviewer:** | Ye Zhang, PhD student from Plymouth University, UK. |

*** represents anonymized information about the specific institution, workplace or location

**Interviewer:** Ok, good. So now I will start the interview. I am from Plymouth University and I am doing a PhD in Product Innovation. I wish to ask some questions from the interview guide that I sent you before, and also I might well explore some of your answers, which might well be slightly different from the interview guide.

The first thing I would probably ask you to do is to look at the second page of the interview guide which is an informed consent form. I need to orally secure your permission that… your consent… about this informed consent form. Because obviously you cannot sign it. *(laughs)*

**Interviewee:** That's fine, I'm happy to give my consent to the interview and I'll send you a signed version of the form by email after this interview, for your records.

**Interviewer:** Thank you. Thank you very much.

**01:06:28** So, you can also find my course providers can keep the information from the informed consent form. If you wish to contact them for any issues. Thank you.

Let me start with the first question. So, for each question, I just need to state the question and you can provide your answers.

So, the first question is, how long are you working in the area of Educational Technology and what is your role?

**Interviewee:** I've been working in the area for something like 13 or 14 years. Currently, I'm the university's e-learning manager which means I head a team of people within the central university IT services who support and encourage the use of e-learning across the university.

**01:05:42** So, that means we support things like institutional VLE, which is based on Blackboard. We encourage staff to use things like voting systems in their teaching and smart words and also I teach and sit on the board of management of things like our PGCAP course for new academic staff.

**Interviewer:** Ok, great. Thank you.

So, the next question is, what are the VLE's in the market that you know and how do they differ from each other?

**Interviewee:** Right, I can give you a very long answer to that question! *(laughs)*

**Interviewer:** Yeah. *(laughs)*

**Interviewee:** Every VLE I've ever heard of! So… but I don't really think that's what you're after!

**01:04:52** I think, in the UK, most people are using one of just a very few. So, you've got Blackboard, which had an enormous market share although it's losing some. You've got newcomers like Canvas, and then you've got some of the free models, so things like Moodle.

**Interviewer:** Yeah. OK.

**Interviewee:** And then, on top of that, there's lots of systems that aren't really VLEs but are trying. So, you've got things like Schoology that are web-hosted that you can create some space on.

**Interviewer:** Ah. OK. So, this is just a basic model right? OK.

**Interviewee:** Yeah.

**Interviewer:** Yeah. So, do you know anything about their differences? So what's the difference between Canvas and…?

**Interviewee:** Yeah, I mean Canvas is an interesting one because it's the newcomer and it's basically just a large multi-tenanted insulation. So, just one big canvas set-up and as an institution you get some space on it. So, it's only available hosted. You hope that your activities are sandboxed from the other users.

Or else, you've got things like Blackboard and Moodle, you've got the option to either host them locally yourselves or go for a hosted option.

**Interviewer:** Oh, right. So, OK.

**Interviewee:** Obviously there's differences in the technology behind them: some are PHP based, some are MySQL some use Java.

**01:03:37**

**Interviewer:** Ah, right.

So, can I say that, because like you have said, they've got different infrastructures, some PHP, some Java, so that results in some differences between their final products/provisions? Like, the convenience to use it, or something like that?

**01:03:17**

**Interviewee:** I wouldn't have thought that the language itself should make a big difference to how easy it is to use it, although a lot of it depends where the rendering is done. So, when you're looking at a page in the VLE, is that being completely built up on the server side and then just transmitted to you in your browser? In which case, it needs a big beefy server, you know, with a lot of power, a lot of memory. And you need a good connection for that to work. Or whether the server's just sent you the minimum information it needs and it's up to your local browser to actually render the content and decide what's required. And that can give a better viewing experience for the user but requires them to have a better standard of browser.

**Interviewer:** Ah right, OK. Thank you.

**Interviewee:** And also, I would think about differences between the sort of, platforms it works on. So, are you looking at something that has a nice responsive design and you use on a desktop machine whether it's running Windows or Linux or OSX. Will it run on a tablet? Will it run on a mobile phone? And is the experience on those things the same, or do you need to use some sort of native app instead?

**Interviewer:** Erm. Yeah. I think for different platforms the user experience will be quite different, for different providers. I mean, I think mostly speaking that students are using them on desktop or from the iPad, or mobile phone nowadays. So, yeah, yeah. So, I'm mainly focussing on those desktop user experiences.

**Interviewee:** That's it too, because I think the way you interact with the desktop is very different to a mobile device.

**Interviewer:** Ah, OK.

**Interviewee:** And one of the things that will probably come up in your questions later on is that a lot of students don't want to have to go in and login on their desktop to the institutional VLE to pull something or to get an update. They're used to getting notifications on their phone or their iPad, configured with all those other tools they're using. And they want that same ease of access to information and updates.

**01:01:05**

**Interviewer:** Oh right, OK

**Interviewee:** And I don't think that's something we've got right yet.

**Interviewer:** Ok, thank you.

Let's proceed to the next question. So, what is important for a Virtual Learning Environment in your view, and what will be important in the future? Who are the customers now and in the future?

**Interviewee:** Right, a lot of questions there! I think, one of the most important questions is, how do you get information in and out of it. So, whenever we look at new software, one of the questions we always ask is, "That's great, if we buy it now and in five years' time want to change to a different vendor, how can we extract our data from your system and import it into something else?"

**Interviewer:** OK.

**Interviewee:** You know, so if we have Blackboard this year and want to switch to Moodle or Canvas next year, can we do that, or do we just need to start from scratch? So, I think some sort of support for standards is very important.

**Interviewer:** Ok.

**Interviewee:** You know, so there we're talking about making sure that things are modelled are around the IMS person object and the IMS course object. And then, if you're looking at linking to third party tools, does it support standards such as LTI? And if you're looking at data with Student Records, does it support standards such as LIS, the Learning Interoperability Standard.

**Interviewer:** Ok.

So, do you think all those important aspects about, I would say ideal VLE, do you think all those aspects have been improved recently, or not?

**Interviewee:** Yeah, I think that is true. Standards themselves are maturing, and so we're seeing vendors supporting import and also export.

**Interviewer:** Oh good.

**Interviewee:** And you can understand, they're always happy to provide an import to bring more people into their systems. But it's important that they can actually provide you the tools to take it out again and put it somewhere else.

**Interviewer:** Oh right.

**Interviewee:** But I think that's only one part of it. A lot of the VLEs, we need to think about what are the primary tasks that our users want to perform? You know, if you're a lecturer on a course, a member of faculty, then what tasks do you need to do? You need to be able to upload content, you need to know what your students are doing, you need to be able to set them assignments, get marks, share content with them.

If you're a student you need to know what's new in your system to be able to meet with your peers, find out what's happening, exchange content, take tests…

**Interviewer:** Yeah.

**Interviewee:** … and know what's changing quickly.

**Interviewer:** Ah, OK.

**Interviewee:** I think one of the things to think about is, where is the control? If you're a student and you want to share something with the rest of your class, are there the tools to do that? Or are you only going to allow them to do what the lecturer lets you do? And equally, if you're a particular lecturer, say in the biology department, you find a great tool that you want to link to the VLE, how does that happen? Do you need to go and talk to your central services and is it a big complicated process, or are there nice lightweight ways in which you can make those connections?

**Interviewer:** Yeah.

What I think is that a Blackboard as a market leader in the VLE market has already been, you know, putting efforts into build up new functionalities and to try to satisfy the demands… satisfy customers like students and the faculty members. So, what do you mean by truly understanding the students job to be done, or the faculty's job to be done? What I mean is that, on one side, Blackboard is dedicating efforts into satisfying their customers and building new functions, do you think their efforts are satisfactory, or…?

**Interviewee:** I'd say no, actually.

**Interviewer:** Oh, right. *(laughs)*

**Interviewee:** I think a lot of Blackboard clients would probably say the same thing.

**Interviewer:** OK.

**Interviewee:** I think, there's definitely a race between the different vendors to bring out the latest features, and if one of them produces something then the other one wants to add it the next day as well.

**Interviewer:** Yeah.

**Interviewee:** The problem with that is, they're not… the core functionality isn't being kept up to date. It isn't consistent enough, and there are still some silly problems that mean that it's not as smooth for staff or students to use as it should be.

**Interviewer:** Oh right.

**Interviewee:** I think, while it's nice to see new functionality being developed, I think you shouldn't do that if it means you're taking away resource that's required to keep the centre functioning as it should. And I think just now, there's too many bits of Blackboard, they don't work well enough together and the workflow is different. So, an example, I was talking with colleagues yesterday… There's two Blackboard products, there's a Blog product and a Wiki product, and in the Wiki product (made by Blackboard) we can create Wiki's and assign it so that only one student can see that Wiki and no-one else can.

**Interviewer:** OK.

**Interviewee:** So, they've got a private space to start with, and then later on, the staff member can share that Wiki across the course with the group.

Now, that works really well and so we tried to do the same thing with Blackboard's Blog product and you can't do it.

**Interviewer:** Oh right.

**Interviewee:** And, it's just really frustrating.

**Interviewer:** OK.

**Interviewee:** And I think that's why they suffer that we've got a huge backlog of different features that have been added by developers over the last 15 or so years, and they're not all being kept up to date as they should be.

**Interviewer:** Oh. Thank you for this, very useful information.

And just the last bit of this very lengthy question is that, who are the customers? Now, and in the future? What this question means is, do you think there is there any customers not currently involved, but will be involved in the future, like primary schools? Is not actively involved… something like that?

**00:54:27**

**Interviewee:** Do you mean customers for us, or customers for VLEs generally?

**Interviewer:** Yeah, for VLE… I mean… because now, normally those VLE models are attracting higher education sectors. Is there any other sectors would be involved?

**Interviewee:** In the US, they're targeting the K12 market, very aptly. But, it's an expensive product and I think in the UK we've seen a lot more fragmented provision with some very weird products that are only available for schools or are a bespoke solution produced by one county council, such as… You know, my son's at school, he's got

a login to a VLE that I've never heard of and is written just for Northumberland council.

**Interviewer:** Oh right.

**Interviewee:** I'm not convinced really that the VLE model is a good fit, certainly not in early years education. Because every pupil doesn't have a laptop or a desktop available to them in the classroom. And it's just… a lot of hurdles, remembering passwords and things. I think we've seen the success of iPads and tablets because you just switch it on and it works and you've got a camera and you don't need any complicated passwords. And I think that one device per person model is probably the way to go in education at school level.

**Interviewer:** Oh, right.

Thank you.

**Interviewee:** I think that possibly in the later years of secondary education, as preparing students for further education, higher education, whatever, there may be a role there.

I also think things you've mentioned just now, going on things like staff training. So, should the VLE be used for teaching and learning. But now we're saying, "Well, we've built this system, can we use it to train our staff in Health and Safety, or to become Fire Officers, or you know, to use Word," or whatever it is you're trying to do.

**Interviewer:** Yeah.

**Interviewee:** That's interesting because it's not really what the tool was designed for and you tend to have courses where you have the entire university staff in them, so they're very big, and what are the performance issues for that?

**Interviewer:** OK.

How about professional people? When they get trained in professional companies? So, do you think, it would be a place to apply rarely?

**Interviewee:** Possibly, but I don't think just now… The problem with current learning environments is, they tend to be based on a course model. So, you study a course, you have your performance in that course, and then you're finished and you move on. And you don't get the overview. So, if you're looking at your training through the lifetime of your work in your company you'd want to see what that person had done over five or ten years, and what would they do next. And possibly across your workforce, a sort of skills analysis – where are the gaps? The current learning environments just don't have the tools for that.

**Interviewer:** Yeah. Quite true.

**00:51:10** How about, because nowadays there's a bad/big one called "MOOC". Do you think a VLE can be well leveraged into the MOOC market?

**Interviewee:** *(laughs)*

I think MOOC's are a distinct development, it's still early days and we are all beginning to understand the cost model, you know, the cost model of MOOC. How they're going to sustain themselves and make money.

**Interviewer:** Ah.

**Interviewee:** Say cursorily you'd ask there, now you're starting to charge for some courses. I think the free ones were fun, I think there will still be some free courses, there's been some really interesting use of MOOC with things like the Ebola outbreak. So, people have been developing courses showing you how to deal with dead bodies, people, or what are the risks? And train people in that sense.

**00:50:26**

**Interviewer:** Yeah.

**Interviewee:** And I can see a lot of people using it for sort of soft learning, so, stuff where you want to do the job better, but may not actually get a promotion for it, but they take the MOOC possibly in their own time.

**Interviewer:** Oh, right. I see.

**Interviewee:** I think it's, you know, a lot of cases, well, there's been a lot of hype about it. The newspapers are very excited.

**Interviewer:** Yeah.

**Interviewee:** There's this new wave that's going to knock done existing universities and break – I don't think that's going to happen.

I think in large parts, it's still a very old pedagogical model. You know, watch some videos, answer some questions, automatic marking, not really much interaction. We're not really understanding how to make the best use of that.

There are these thousands of learners all connected. How can we actually make use of those numbers and get more people, you know, all the activities, so it's not

just one person talking to a computer, there's 10,000 people, let's do things we could never do in a class of 30.

**Interviewer:** Oh.

**Interviewee:** And that's the challenge that moocs really need to answer.

**Interviewer:** Yeah, yeah, the changes. Thank you.

So, let's move to the fourth question. So, which VLE was adopted by your institute and why was it chosen?

**Interviewee:** Well, that's an easy one!

**Both** *(laugh)*

**Interviewee:** We chose Blackboard and it was in either 2000 or 2001.

**Interviewer:** Oh?

**Interviewee:** So, we've had it a long time. And essentially, the year before we were involved in a pilot with just a few departments involved. It was with biological sciences and a couple of others. And they were looking at a bespoke VLE that had been developed by Newcastle and Nottingham universities to support the medical teaching.

**Interviewer:** Oh right.

**Interviewee:** And this is VLE that's still used in Newcastle.

**Interviewer:** Yeah.

**Interviewee:** I think it's called "NLE" for Newcastle Learning Environment. And it supports their medical curriculum.

That was interesting, and the staff who were involved really liked some of the features of the VLE, the fact that it was a place to organise things and it could upload things and students could see it. But the particular implementation of that tool wouldn't scale well for us. But it was enough that we decided then that the university needs a learning environment.

So, we went away, actually I wasn't at the university at this time, it was about two years before I joined. But my predecessor went away, had a look around and basically she decided that… we had a very small team to support it. We didn't have the expertise to write our own. So, we wanted a commercial solution, where if there were problems we had a contractual relationship with the vendor and we could say, "This bit isn't working. Please fix it."

And so, really at that time, the two products we were looking at were either Web CT or Blackboard. It was very close which one we went for, in the end we went with Blackboard, and that's where we've been ever since.

**Interviewer:** OK.

**Interviewee:** But something that was important about that decision was that the university decided that there would just be one virtual learning environment for the university. So, you wouldn't have different schools or departments *(audio breaks)* we felt that that would be confusing for students and staff. There should just be one system.

**Interviewer:** OK.

So, all other years, have you chosen Blackboard? So, have you ever considered switching to another one? Or never considered it?

**Interviewee:** We have looked at it, and we've continued to sort of review… keep our eye on other systems and obviously we talk to colleagues at other institutions on a regular basis. Just now, *(audio breaks)* that's so much better than what we have now that it's worth making that switch.

Also, because we have a lot of content on the system, it would be a very difficult process to actually manage the migration.

**Interviewer:** Oh right.

**Interviewee:** We're probably looking at a 3-year project to actually move the content across.

**Interviewer:** A 3-year! That's a very long…

**Interviewee:** Well, what we do at *** is, if you're actually… can remember… give your students a programme, you see all *(audio breaks)*… so if you're a graduate here for three years, you'll see this years' set of courses, last years' second year and first year courses. So, we're maintaining a lot of content.

**00:45:51**

**Interviewer:** Oh.

**Interviewee:** Well, if we migrate we'd be prepared to migrate, or just build a new current years' courses. I don't really want to do that for every course at one time.

So, I think we'd probably run a parallel system with all the courses on the Blackboard system, not updated and new courses on the new one.

**Interviewer:** Oh right, OK. Thank you.

The next question is, how is the decision-making process for VLE procurement? How were different VLEs reviewed to arrive at the selected VLE and how did the final decision reflect different stakeholders' opinions?

**Interviewee:** Essentially, I mean… for the initial selection, that was before my time. But, it was informed by the people who had actually been on the pilot project working with Newcastle. So, they knew the strengths and weaknesses of a VLE. And they charged a couple of individuals within the IT service to go and have a look at different systems and produce a matrix of the different feature sets. They evaluated five, largely by the staff. I would say, if you were doing it again now, there would be a much greater student involvement.

**Interviewer:** OK.

**Interviewee:** To be honest, I think we were really thinking about what best suited the way we taught at *** at that time. So, the decision… there would have been student representatives there but only in small numbers. And that's something that, you know, if we were doing a large-scale re-procurement exercise, we would definitely involve a lot more students.

**Interviewer:** Yeah, yeah. Thank you.

The sixth question is, was the VLE adopted university wide, and was there already a VLE in place before?

**Interviewee:** That's an easy one to answer! Yes, it was adopted university wide, and no there wasn't one in place before.

**Interviewer:** Ok, thank you.

So, what is the version that is currently used? How does it compare to prior versions? Any aspects have been improved or not?

So, there are different versions.

**Interviewee:** Yeah.

**Interviewer:** Is the… using the most updated version?

**Interviewee:** We are, yes. We are using the latest version of Blackboard, so we're 9.1, the April 2014 release. There's a new release that's meant to be out this month, but we think we'll slip and probably wait until November. We did an upgrade in August, to the latest version that was available.

**Interviewer:** Yeah. I think one of the questions you can answer, very well, because you have been in *** for some time, is that have you been happy going through those different versions? So, from a comparative perspective, just any aspect of the product has been constantly or consistently improved over time?

**Interviewee:** I don't actually think there's been that sort of consistent drive, where you can say that things have always got better or the focus has always been on one thing.

I think there's a couple of things that are happening.

**Interviewer:** Yeah.

**Interviewee:** Without a doubt, there's been a focus on the performance of the system and how it responds to increasing use and increasing load. In general, that has got better.

**Interviewer:** OK.

**Interviewee:** And over the last three builds, that really has improved.

**00:41:28** And that's largely because Blackboard have been doing the work to identify queries that take up a lot of resource that slow the system down, and trying to optimise those, or change when they're called. And we're seeing much more use of caching information and things.

**Interviewer:** Hmm.

**Interviewee:** So, that… you know, as you understand the technology you're trying to use it, or make it do the best job it can.

**Interviewer:** Ah, OK.

**Interviewee:** So, that seems to be good. There's also… the fact that most of the software developers are based in the US and you know, that's their largest market. I think the UK is their second largest market.

**Interviewer:** Yeah.

**Interviewee:** Or certainly, you look at in on dollar revenue

**Interviewer:** Yeah

**Interviewee:** What it has done over the last couple of years is try and understand that international market a bit better. And that's not just saying, there's either an American version and an International version, it's going to the different… for example, in the Netherlands there's an awful lot of work on peer assessment and group work. And probably the Netherlands and Australia are the two leading countries in that field. And so, that's the areas that Blackboard staff we're talking to – Australian and Dutch clients – are trying to say, "where can we help?"

In the UK, one of the issues is, there's some would say, almost a strange obsession with wanting to use anonymous assessment. So, when you submit your work, it doesn't add your name on it. And when the staff mark it, they're not meant to know who you are until after the marking process. Sometimes you can have processes where one person marks it, and then a second person marks it, and then they compare the two marks. Those workflows just weren't supported on Blackboard until this year because that's not a model that's very common in the US. So, Blackboard spent quite a lot of time working with UK clients over the last two years, understanding how we perform assessments and they've just released tools to allow that sort of moderated and anonymous assessment. So, that's nice to hear, and see features that we've been asking for, for a long time actually coming to fruition.

**Interviewer:** OK.

So…

**Interviewee:** To go that one step though, it's still a rather fragile thing. So, from that if you had the wrong version of Firefox or Internet Explorer and the right version of Java installed, you know, things can go wrong.

**00:39:05**

**Interviewer:** Ok.

**Interviewee:** And I think, too many times, when a student or a member of staff has a problem, we say, "Oh, you're using Internet Explorer. Well, try Chrome, it'll just work." And I think, partly it's a problem of any tool that runs on the web, the browsers do interpret pages differently, but that's not something that Blackboard have really done much to solve.

**Interviewer:** Ah OK.

**Interviewee:** And that can be very frustrating.

**Interviewer:** Oh right, OK.

And, do you think that Blackboard, or other VLEs have been trying to add into the new features? Add into the product new functionalities? To make it more and more feature-ridden and do you think so, or...?

**Interviewee:** I think it you look at the company's history the answer to that question has to be "Yes,".

**Interviewer:** Yeah.

**Interviewee:** They've either developed themselves or they've bought over companies that were providing that sort of functionality and integrated it into the product. I don't think that's a sustainable approach and as I said earlier, there are some issues with what

seemed like very similar tools are a very different workflow. And it's not – or they don't integrate as well as they should.

And one thing that Blackboard are trying to do is, as well as the experience for the end user, they're actually looking at their entire infrastructure model behind the scenes. So, they're looking at things like, if you use their mobile tools, the data may be sitting in one part of the states. If you're using their collaborate tool, the data sits in a data warehouse on the other side of the states. And, firing up those two systems sitting next to each other and they don't have a common data structure behind them, so you're storing lots of information three or four times, which is an indicator for it being wrong, and just making everything much bigger than it needs to be.

**00:37:27**

So, I think, younger tools, may have got these decisions right first time, learning from the mistakes of Blackboard. I think to an extent, Blackboard are very keen to advertise about the changes they're making that we can see in the product, but actually, they are making and they need to be making lots of changes behind the scenes as well.

**Interviewer:** Oh, right. Thank you.

OK.

So, I mean… the eighth question is, what are the teaching faculties feedback in using the selected VLE?

**Interviewee:** I think we can sort of split people into two or three categories.

There are the people who are relatively happy with it, who've got what they need, they've worked out how to use it and they just get on with it.

I think there are some people who absolutely hate it, think it's the wrong thing, don't like the way you have to organise content and would prefer not to use it at all.

And there's a third group who are in the middle. Who use it, but don't feel particularly confident with it, or concerned that they haven't got things set up correctly or come across problems.

**Interviewer:** Oh, OK.

Sorry, can I just interrupt you here, because you have just provided some very important information.

There are three distinct groups. Do you think, what are the factors, that make those distinctions? For those different groups?

**00:35:15**

**Interviewee:** Some of it is definitely time.

**Interviewer:** Time?

**Interviewee:** How much time they've got to spend setting things up.

**Interviewer:** Ah, OK?

**Interviewee:** And, one thing that the staff certainly don't like is if there's a major change to the interface. So, things look different from year to year, they suddenly don't know how to do things.

**Interviewer:** *(laughs)*

**Interviewee:** I think there are a lot of administrative tasks that are delivered by Blackboard. And they don't want to spend any time on those, you know, they just want the groups to appear, and to create an assignment and move on to what's important to them in their learning and teaching. And that's not deciding feedback settings on a form and things.

So, if they don't like it, or have any negative feelings and something goes wrong, then it definitely undermines their confidence.

So, I think the group who are happiest, are the ones who've actually spent most time using either Blackboard or other IT products and Business Software and know what they're doing.

**Interviewer:** Oh, right.

**Interviewee:** The ones who are unhappy probably fall into one of two groups. Either they just never spend enough time trying to understand it, or they're frustrated that the limitations of the tool, and every tool has limitations, but limitations in Blackboard that they see are things that really matter to them. So, there's something they can't do that they'd like to be able to do.

And often they think you can do it in another product. You know, so they say, "Well, why don't we have Moodle because it will do this or that?"

**Interviewer:** Yeah.

**Interviewee:** And sometimes those are very well founded and you know, they're right, we could do these things in other tools, and sometimes they're not.

**Interviewer:** Yeah. You mentioned that… the term "frustration" and that is very representative of the user experience.

**00:33:26**

**Interviewee:** Yes.

**Interviewer:** …a feature of the virtual learning product. Can I ask what are the reasons of this frustration is because the product does not have the relevant function, or because it is uneasy or difficult to use?

**Interviewee:** I think there is both, but without doubt, we get people say, "I wish Blackboard would do this!" and you say to them, "Well, it does." And they're just not finding those features.

**Interviewer:** OK.

**Interviewee:** And, one reason could be terminology that they just don't see the names, or they don't know what the options are. And others are, sometimes the workflow. There's a basic workflow and then there are some more advanced options. And they just never explore the advanced options.

**Interviewer:** OK.

**Interviewee:** And, others, it may just be the way the company has… you know, the functional specification of the task view, doesn't match the way we want to do it in ***.

**Interviewer:** Ah, OK.

**Interviewee:** And those are much harder to fix. And sometimes we will have to make a bespoke application ourselves, you know, to meet that need. Or try and buy one. Other times we just have to live with it or talk to the company about changing it.

**Interviewer:** OK. So, you just said a bit of both, so the proportions are more or less the same as each other, or what do you think?

**Interviewee:** I'd find it hard to say for sure… You know, I could say, "Yes, I think its about 50:50" but I don't think I can justify that claim.

**Interviewer:** Yeah. OK. Thank you for your answer.

So, the ninth question is, what do the students think about using the selected VLE?

**Interviewee:** Right. I think in general the student feedback is relatively positive. They like the face that there is somewhere to go to find the lecture notes, to find the tests. You know, to tell them what to do essentially.

**Interviewer:** Yeah.

**Interviewee:** There's frustration when it's not used consistently. So, as a student they would like to go into a course on Blackboard and always have the folder of assignments where they find their assignments. Always have one called "lectures" where they find the lecture notes, and so on.

Currently, we don't have a standard of arranging courses, that's left up to the individual faculty who teach the course or organise it.

**00:30:58**

**Interviewer:** OK.

**Interviewee:** There are good reasons for that, because different subjects teach things in different ways. Some want to just expose the content week by week and others want to show the whole lot. But it is conducive for students. And certainly, students will recognise when lecturers use all the features of Duo or Blackboard well and when they don't. And they'll say, I don't know, "Why doesn't my Physics lecturer put all his reading online on Blackboard, when my Chemistry lecturer does?" They don't like that difference; they expect them all to do the best.

**00:30:25**

**Interviewer:** OK. So, the…

**Interviewee:** I think also there's a frustration that there's not a better experience on the mobile device.

**Interviewer:** Yeah.

**Interviewee:** That is their device of choice now, and they want a better experience than we can offer just now.

**Interviewer:** OK.

So, you just mentioned that the inconsistency of the user experience is almost related to experience across different subjects?

**Interviewee:** Yes. Exactly that.

**Interviewer:**

**00:29:35** Mostly subjects. Any other inconsistencies they feel using the product? For different platform or..?

**Interviewee:** …Not that we've come across.

**Interviewer:** Ah, OK.

**Interviewee:** But also, one of the things that Blackboard lacks is a good Search function.

**Interviewer:** Good Search function?

**Interviewee:** They're used to it in nearly every other system they've got, you know, this is the Google generation! Where you just type it into Google and it finds it, and suddenly they're faced with a system where there's no Search. So, how do you find your lecture notes, your assignments, whatever it is?

**Interviewer:** Have you reported this problem to Blackboard?

**Interviewee:** We have, and they're aware of the request, but currently because of some of the ways they've designed content and… they've got some rules so, there's a feature in Blackboard called Adaptive Release. So, you can say, "I'm going to make this piece of content available to students, ONLY if they complete a certain test, or they get a very high mark, or low mark, or do this or do that or certain things." I think the computational one, that it's too hard for Blackboard to go through all the content searching for some term and then working out if that student is entitled to see it at the moment.

**00:28:18**

Now, that to me, is a very poor excuse, because, you know, we have computing resource now, we should be able to answer those questions. And it's a problem entirely of their own making as well.

**Interviewer:** Ah, OK.

**Interviewee:** You know that's…what's there needs to be re-coded.

**Interviewer:** Ah, OK. Thank you.

The tenth question is, do you think the selected VLE has been running as expected? Any issues? Any aspects doing well? Any to improve?

*(laughs)* Sorry to repeat the…

**Interviewee:** Look, there's lots there. Yes, you're right, it does repeat parts of conversation. One of the things that we've been looking at and trying to improve is just populating courses on Blackboard. So, getting information from the student record system into the courses, so that when a lecturer opens the course list first time, it has all the students on there who have signed up for the module.

And equally for a student, when they start university, it shows all the courses they've got and it changes as it should. There are still problems with that process. And we've actually got a colleague with Blackboard at the moment because… as well as enrolling on your courses, we say which department you're from, which college you belong to, are you a member of staff, are you a student? And we use lots of other labels, essentially some sort of role, to display other content to you within the system. And the logic that processes that data is going wrong.

We know our data, the files are correct, because Blackboard have checked it and the log says there's no problem and yet it doesn't do what it's meant to do. So, there are still issues at that back-end integration. Even though it's something that Blackboard have spent a lot of time trying to improve.

**Interviewer:** OK.

**Interviewee:** And that's important, because when those base level things go wrong, it just stops the students or staff from being able to use it altogether.

Now, the worst case, you could log into Blackboard and see nothing.

**Interviewer:** Oh, OK.

**Interviewee:** And that's not a good experience!

**Interviewer:** Yeah.

**Interviewee:** Particularly if you're a new student and your first experience is "Error". Nobody looks good there and that's the last thing we want for our students.

**Interviewer:** Ah, OK. Thank you.

So, the 11th question is, Who are the vendors supporting the selected VLE and how do they carry out their supports? How do they respond to feedback from VLE users?

**Interviewee:** Right, well there's… The vendors we've got… We've got the core platform that's made by Blackboard. And then we've got a few other components. So, we've got things like the Turnitin Plagiarism Detection Service, we've got blogs and wikis by a company called Learning Objects, and we've got PebblePad plugged into it and some other tools. Those all sort of comprise the learning environment.

Talking about Blackboard first of all, obviously we get direct support from the vendor. If there's a technical problem, we put in a support ticket and then that's managed by them and they've got a formal support policy with different levels: Tier 1, Tier 2, Tier 3, with different levels of expertise and different response times to fix

problems. They've got it classified as well so we can print out a documentation request or something minor and that will go to the system, but it won't be resolved today. Or *(audio breaks)* not working, emergency request, and in that case they've got a phone number they give us and we can call them up directly and they will work with us.

**00:24:26**

**Interviewer:** Ah.

**Interviewee:** *(audio breaks)*

The technical support people are very good at Blackboard, that is one of their strengths, and also the user community itself. There's a lot of self-help. So, if we have a problem with the system or we want to look at tuning the servers, looking at how much Java memory to give it and things, then there's a lot of discussion boards and things that Blackboard staff are on and people like myself that exchange settings quite happily.

So that's a strength.

The issue really is deciding which things should get fixed. So, if it's just changing some parameters then that's an easy problem and they can help me with that, but if it's saying, "I think this is broken" or "I want a new tool that does x, y or z" then that's much harder to get through the process.

Blackboard have tried lots of different things. They have some online communities, they use a tool called User Voice, where essentially you can login, people can make suggestions and other clients can broach to say yes that's a good idea or not. And that tends to prioritise things.

They've changed from year to year depending on the senior management team at Blackboard. And that… And I think a problem for us is that it's not always clean how you get those decisions made, you know, how you influence them.

**Interviewer:** Yeah.

**Interviewee:** So, you can talk to Blackboard developers and you can go and… certainly attending the conferences is a very useful way of getting to see the project managers, the product managers, the developers, you know, the leadership team and making sure that they hear our requests. And understand the pain.

**Interviewer:** Yeah.

Yeah, just as you said that you need to resort to those tactical stuff from Blackboard or get some suggestions from the Blackboard community, and so, can I just ask in terms of how often you do these kind of things? Do you think over the years, it's become less and less often, or become more and more often, do you think? How do you think? Frequency…

**Interviewee:** … I think there was a period about five or six years ago, where I think there were some fundamental problems with the product. They tried a big upgrade, they made too many changes at once and things really didn't work well for a while.

**Interviewer:** Which version? Do you remember which version?

**Interviewee:** Err… 9.0.

**Interviewer:** 9.0. OK.

**Interviewee:** And I think 8.0 wasn't very good either.

**Interviewer:** *(laughs)* OK! Alright.

**Interviewee:** I don't think 7.2 was very good either.

**Both:** *(laugh)*

**Interviewee:** 9.0 was a big jump. They changed the user interface a lot, it wasn't ready and they released it too quickly and it caused problems.

So, I think they are getting better now. And since we've seen Blackboard move to hosting a lot of their own clients, then they get to see a lot more of the clients themselves.

**Interviewer:** Yeah.

**Interviewee:** Because they're not just selling software, they're running it and running it at scale, you know, so they have hundreds of institutions whose Blackboard servers are running on Blackboard's hardware, in offices in Amsterdam and San Francisco. So, that's also given them access to a lot more data behind the scenes to work out which queries are going wrong, which things are breaking, which things are slowing things down. And I think that's why we've seen such improvements in performance.

**Interviewer:** Yeah.

OK, so…

**Interviewee:** I'm sure there was… I think there's tension now in the daily market about whether you go for a cloud hosted solution or you allow clients to install it locally.

**Interviewer:** OK.

**Interviewee:** You know, and I think for the vendor it's much easier if it's cloud based, because they're in control to a much greater extent than the backend and the version of software that's running and the configurations. Whereas currently we host the data ourselves, partly because of concerns about data integrity and wanting to keep things locally. You know, knowing that we have back-ups and that we believe that it's really gone, because that's the other thing, that the legislation in this area has become much more difficult and more constrained over the last 15 years. So, you've things like the Freedom of Information Act, and Data Protection Act, that limit how long we can keep things for. You know, and rightly so, but we have to make sure that we get rid of old content and with EU legislation as well, if you're dealing with American companies, you need to make sure that they are signed up with a Safe Harbour agreement and there's a lot more political expertise that we draw to look at the contacts and make sure they are using our data appropriately and safeguarding it.

**Interviewer:** Yeah.

Erm. You just mentioned there is a fundamental improvement in the version 9.0 and caused a lot of problems. Can I ask why is such a substantial change?

**Interviewee:** 9.0 wasn't a good version. 9.1 is a much better version.

**Interviewer:** Oh, right.

**Interviewee:** And I think that's largely because they learnt a lot. I think they lost a lot of customers moving to 9.0 and it broke things and it was at a time when people were wondering, "Well, should we stay with Blackboard?" You know, it was unfortunate

for them that a lot of their customers were probably four or five years old and were now due the next institutional review and deciding whether or not to stay with Blackboard. And, desire to learn and Moodle are saying, "Well, come and use our stuff instead."

**Interviewer:** OK.

**Interviewee:** Whereas 9 – I think they invested a lot of time and improved to an extent a lot of their testing processes before they released 9.1.

**Interviewer:** Oh, right. OK.

**Interviewee:** But it's still not perfect.

**Interviewer:** Yeah. *(laughs*)

Let's move on to question 12. Have you communicated with VLE companies about your expectations of their products and have they responded positively to your communication? Are they making the right trade-offs? Do they have the right competencies for the future?

**Interviewee:** The answer to that is a partial, "Yes".

**Interviewer:** Yeah *(laughs)*

**Interviewee:** We certainly… we have a lot of dialogue with Blackboard. One of the things we do is make sure that we get involved in these communities, we go to listening sessions, we run an annual conference for Blackboard users here at ***. We have Blackboard senior executives coming down. So, they know what *** wants, that we're keen to get involved and spend time on betas, to try and develop features

with them. And I think that's important. You know, with a company, it's a two-year relationship. You have to give some of your time, in order for them to listen to you.

What's not so clear always, is understanding what those trade-offs are. You know, being part of the decision that says right – oh, sorry I'll just move! I'm in a room where if you don't move around for five minutes….

Right, you can just about see me there. Hopefully it'll come back. Anyway. Understanding whether Blackboard choose to invest in these features or in infrastructure is probably not a conversation that I'm party to. And those things I think are still held at high level with a very small group. And probably mostly only their US clients.

**Interviewer:** OK.

**Interviewee:** So, it might be at most five or six universities that have enormous contracts with Blackboard that will be involved with those sort of discussions.

**Interviewer:** Have you ever found or observed if there are some product features or functionalities if they have improved in the favour of those five or six contractors with Blackboard but at the expense of others?

**00:15:06**

**Interviewee:** Erm…

It's a good question… I think that we can see certainly when new features are rolled out, sometimes they're rolled out and it's really only for the US market.

There's a feature in Blackboard – an ecommerce feature – which allows you to buy and sell things through Blackboard and make payments and that was never rolled

out into the UK or Europe. It was too expensive for Blackboard to negotiate with the banks.

**Interviewer:** Ah, OK.

**Interviewee:** So, that… there's loads of development tied with that, that we never saw.

**Interviewer:** OK.

**Interviewee:** There's tools specific to American legislation, the FERPA Legislation, which is basically protecting children at school and their identity. There's a lot of reporting tools for that that are of no use, because the law doesn't apply.

**Interviewer:**

**00:13:48** So, asking because they have to a single version of Blackboard because this area has a single version and so anything that improves in the favour of the American universities, however they also roll out in the Blackboard that is used by ***?

**Interviewee:** Some of them, but another example is, that they spent a lot of time negotiating with NBC in America to embed the NBC content. If you were a lecturer you could choose any event in the archives for free and stick it in your course. That never came to the UK. We weren't allowed to use it, because the deal they had agreed was only for North America. That would mean any client in Africa, any client in Asia wouldn't be able to use it either.

**Interviewer:** OK.

**Interviewee:** That said though, there are some features that we have requested, and any time you request for change, Blackboard will give you a number and sometimes when the new version comes out, you'll get to the email saying, "Hey Malcolm, you

requested this feature two years ago, and finally it's made it to the product!" You know, or, "we've fixed this and implemented your enhancements".

**Interviewer:** Oh, right, OK.

**Interviewee:** Those tend to be small features generally, or else they're features for the entire UK community, if you like, the anonymous and multiple grading support that I talked about earlier.

**Interviewer:** Oh, OK.

What do you think would be the difference in terms of the institutions… I mean… what's the difference between the major contractors with Blackboard and *** and is there any difference in terms of the institution size? Or faculty members? Post-graduate size? Is there any difference?

**Interviewee:** Sorry, you're comparing *** with who?

**Interviewer:** The major contractor, major customers…

**Interviewee:** What, in America?

**Interviewer:** Yeah.

**Interviewee:** I think, one, it's just scale. *** is relatively speaking a small university, maybe 15,000 undergraduates. Some of the institutions in America we're talking 50,000, 60,000, 80,000. And also, sometimes some of those institutions are part of a regional consortium. So, it might be that the whole of Chicago decides to buy a

Blackboard for it's FE college equivalent and things. So, obviously those groups have a bit more of… *(audio breaks)* when they're negotiating those contracts.

**00:11:06**

**Interviewer:** Oh, right.

**Interviewee:** And you know, it's a commercial company. Whenever there's a decision, with any client they work out how much money would this cost us to do and how much money is that client bringing in.

**Interviewer:** OK. I see. Thank you.

Just move to my 13th question. Is there anything more you would like to add? Or are there other people that you know that could contribute to this study?

**Interviewee:** Erm… anything else I'd like to add..?

Hmm.

I think it's a difficult area this. There's been a lot of talking about developments of VLEs and then for a while there was a lot of talk about, "Well, the VLE is dead!". And now, it's all this being personalised learning environments that you construct yourself. So, you might use your vlog and a whole load of different tools to manage your learning materials.

Personally, I don't think that's the case. I think there's still a need for a central system for assessing students and managing content and pushing things out. But there's no doubt it's an interesting time.

And, you know, we've seen the challenge of mobile devices and the sort of "app" model of doing things. And I think it will be interesting to see how VLEs manage to respond to that, or whether it's just a very short-term thing and in 10 years no-one will be using apps anymore there'll be a different way of interacting with systems.

But if you look at a task like faculties marking work. A lot of them now want to be able to juggle the work to their iPad and mark on the train or in the garden or at home, not necessarily online. And then be able to upload that work later on. They like the fact that you can touch the screen and annotate things easily, you know, with a stylus. And it's how do you give them that sort of activity, not just for marking, but for students creating content and using the learning environment to actually build and construct things, not just a place as a destination for content.

**Interviewer:** OK.

I've just got some questions from your answers. If I were to ask you to give a judgement about three stakeholders, like faculty members, architectural staff, administrators and students. Do you think if there was another chance to review which product you should use in *** University; which stakeholder would be most influential? Would it still be staff, because you mentioned the students may pose more impact, do you think? Comparatively, do you think the faculty staff would be the most influential stakeholder?

**00:08:02**

**Interviewee:** I think staff have a very important say in it, because they're the people getting to use it for the longest. You know, our students will be with us for a few years and then they move on. But having said that, looking at the University of Birmingham, they've just been through a big institutional review and they've actually chosen Canvas as their VLE. One of the things they liked about it was it looked different. With a market governance of Blackboard, a lot of institutional websites look very much alike. Sorry, I'm losing more lights here now!

**Interviewer:** *(laughs)*

Sorry to give you…

**Interviewee:** A lot of institutional systems look very similar. You know, they've all got that Blackboard look and feel, and if you're somewhere you want to differentiate yourself or make things look different, sometimes just buying the new system seems helpful.

I think there will be a lot of… In staff, they'll be wanting to see how does it fit in with what we've already got? And making sure that workflow systems like Turnitin integrate. Students, I think, are much more willing to look at what are the new things. They'd probably look at it quite differently.

It would be a compromise in trying to find the solution that fitted both those groups, but also met our long-term technology plans, made sure that we've got the data security model and things in place.

**Interviewer:** Ah, OK.

**Interviewee:** I think it's a much more mature market and institutions don't just do a comparison of two sets of features and choose the one with the most ticks, I think they're thinking a lot more about the lifecycle of the product and what the relationship is going to be like with the vendor, and support and development, forwards.

**Interviewer:** OK. Thank you.

Canvas was chosen by Birmingham University, why do you think they prefer Canvas?

**Interviewee:** I think it was a very close thing between Blackboard and Canvas, but some of it was just the fact as I was saying that it looks different. And I think marketing

departments in particular like the face that Birmingham's web presence will be different to the others. And they felt that was important.

**Interviewer:** Ah, OK.

**Interviewee:**

**00:05:20** So *(audio breaks)* someone different in the market.

**Interviewer:** Ah, OK. Thank you.

So, my last two questions are, have you found every aspect of any function or products or attributes of Blackboard has been already provided? Like too much *(audio breaks)*…can you identify any aspect, like too many functions or too…?

**Interviewee:** I think, one of the criticisms of Blackboard is that there are too many ways to achieve the same task. You know, there's four or five possible workflows to make some changes and some of them have some very important but subtle differences that aren't clear to the person who uses it.

So, I think often there are too many ways to do things and they would do better to slim it down. And just make one route that was consistent throughout.

**Interviewer:** Ah, OK. And do you think the number of those different ways has increased across different versions?

**Interviewee:** Yes, I think they have increased.

**Interviewer:** Ah, OK, thank you.

My last question is, do you think any aspect or any attribute of Blackboard has been improved at the expense of another aspect of Blackboard?

**00:03:34**

**Interviewee:** I think a couple of years ago they made a decision to try and get away from big… before you updated the system you basically had to do a whole system update, so you would take it down, apply an enormous fix and then bring it back up. And that was too difficult and it was something they acknowledged you'd only make once a year. So, they tried to break it down into little parts, ok now there's a change to the discussion board, if you want that, download the discussion board fix, apply it and you've got a new function. And we had more control about when that happened.

But the downside is, it makes it much more complicated, because you don't just have the core version, you've got the core version of Blackboard plus which assignment tool, which blog tool and a whole load of other things.

While it was a good idea in some ways, I think the outcome is just too complicated and there's just too many different permutations. So, if you upload a new discussion board tool, it might work unless you've got a very old or very new version of the class photo tool, or something silly like that. There's just too many complications behind the scenes.

**Interviewer:** Thank you, thank you very much.

Thanks for your time with this, my interview.

**Interviewee:** Could you just confirm which email address you use? Because I tried to send one to hotmail.com and it bounced back. Is it hotmail.co.uk?

**Interviewer:** Yes, it's hotmail.co.uk and when you send the form could you also send it to my university address?

**00:01:35**

**Interviewee:** OK, I'll send you the form after this meeting.

**Interviewer:** Thank you, thank you very much.

Could I just ask, because I recently interviewed some of the staff from Blackboard, do you know some of the staff at Blackboard?

**Interviewee:** I do, yeah.

**Interviewer:** OK. Could you just… when you send me the consent form, could you just tell me any contact information that I can use to contact those staff?

**Interviewee:** What sort of people do you want to talk to? Is it developers, is it project managers? What interests you most?

**Interviewer:** I need to know some people from the product innovation side, so developers, yeah, developers would be the key informants that I would like to look for.

**Interviewee:** What I'll do is, I'll send you contact details of a woman called Dimitra who used to work for, I think, Kingston University and works in Blackboard's international office in London, and she'll be able to put you in touch with whoever you want to talk to in the company.

I'll send you her email address.

**Interviewer:** Apart from her, anybody else you know, from the marketing department, or from...?

**Interviewee:** Well, these *(Inaudible)*… Dimitra will be happy to provide you with that sort of information.

**Interviewer:** Thank you, thank you very much.

**Interviewee:** OK?

**Interviewer:** Thanks for your time.

**Interviewee:** No problem. Bye.

**Interviewer:** Bye.

## Interview Transcript (2)

| | |
|---|---|
| **Interviewee:** | E-learning director from a Post-1992 university in the UK |
| **Interviewer:** | Ye Zhang, PhD student from Plymouth University, UK. |

*** represents anonymized information about the specific institution, workplace or location

**Interviewer:** OK, thank you for the interview.

**Interviewee:** That's OK.

**Interviewer:** First, I need to get your consent.

**Interviewee:** Shall I sign?

*(Papers rustle)*

*(Sounds of someone writing – the consent form is on a desk and they are completing it)*

**Interviewer:** Perfect, alright.

So, the first question is, what is a VLE in your view?

**Interviewee:** What is a VLE?

**Interviewer:** Yeah.

**Interviewee:** A VLE can be any set of tools that allow you to teach and learn at a distance. So, that could be something like Moodle, which we use here, which is a managed learning environment, or it could be something else. It could be something like Twitter.

**Interviewer:** Oh, right.

**Interviewee:** Or Facebook, or Google Hangouts.

**Interviewer:** Yeah.

**Interviewee:** It could be anything that could be used to learn virtually.

**Interviewer:** Thank you.

**00:26:07** The second question is, how is research and development organised within your organisation?

*(Inaudible)*

How long are you working in the area of educational technology and what is your role?

**Interviewee:** I've been involved in educational technology since 1976. In various roles, mainly as a researcher and as an educator, more recently. I suppose I joined the university in 1998, but even before then, round about the late 1980's I was doing research into things like computer-based learning. My role now, I'm Associate Professor of Learning Technologies, I lead several academic teams here and we

also have a group within the Faculty of Arts and Humanities which looks at Digital Learning Futures, which I am the chair of as well.

**Interviewer:** Thank you.

What are the VLEs in the market that you know, and how do they differ from each other?

**Interviewee:** I think that, if you're talking about managed learning environments, the formal set-ups, then they don't differ from each other very much at all. Moodle is very similar to Blackboard, which is very similar to Desire2Learn, which is very similar to Sakai.

**00:24:42** I think the only difference is that Moodle and Sakai are open source and they are therefore liable to a lot more change because of the communities that support them, the user groups, because they're open source. Whereas Blackboard and various other tools like Desire2Learn, they're very much proprietary and therefore less open to change because the changes only happen when the companies allow them to happen. So, that could be once every six months to every year. But I think generally speaking they are very similar to each other. They both have repositories of content; they both have communication systems. They all have the ability to be able to create content, like blogs and wikis. They all have the ability to communicate between students and each other and also students and content experts. So, they're all very similar to each other really.

When you talk about the open… the non-aggregated tools like Twitter and Facebook and Google, those are much more informal in the way they're used. So, they're liable to a lot of change, and they're very, very different to each other. They have different functions and therefore different users.

**Interviewer:** Thank you. You just mentioned the similarities, and what is different…

**Interviewee:** Yep.

**Interviewer:**

**00:23:20** …about VLEs. In terms of the open use, I think Blackboard is the proprietary software, is increasingly open. Do you think there is a trend for every VLE to become more and more similar?

**Interviewee:** I think what's happening… When I talk to people like Blackboard, and I've talked to people like Frentor in the past who… they're a part of Blackboard of course, and Horizon, Wimbor, people like that. What they've all been saying is that they need to go more open in terms of the way they operate. I think the problem with a lot of VLEs, typically the managed learning environments is they've been run on a walled garden approach, which means that clearly if you're inside the walled garden, you can access everything. If you're outside of it, obviously you can't access anything. And therefore, if the people who are inside, students who are inside an institution are trying to connect with people outside and share their content, it's impossible or very difficult to do.

So, therefore, I'm thinking that a lot of them are now thinking about opening up their content more and becoming more democratic in the way that they're delivering the infrastructure now.

**Interviewer:** Thank you.

So, what is important for a VLE in your view and what will be important in the future? Who are the customers now and in the future?

**Interviewee:** That's two different questions. I mean, the first question… For me, the most important thing for a VLE is that we stop the things like the homogenisation of content. Stop things like the walled garden approach. We start to think about being more open and democratic in the way they're run. And that means that often we have to give students the option to change things. Which at the moment is impossible to do with lots of VLEs. So, the most important thing for me is that we open up learning.

**Interviewer:** Oh.

**Interviewee:** In other words, we make learning more accessible to everybody.

And that also includes, I think, bringing in people from outside, who might not even be students or staff, but we can have the ability to bring them in to VLEs to share their ideas and so on.

And the second question was what, sorry?

**Interviewer:** What will be important in the future?

**Interviewee:** Well, the important thing in the future will be open education, open learning, open access, open scholarship. The whole idea behind openness is that it's made available to everybody.

So, for instance when I write a blog post, or when I create a set of slides for a key notes speech, or whatever, I always share them online for free. I label them with a creative commons licence, which means that anybody, as long as they attribute that content to me, they put my name on it, they can use it in any way they wish. So that, from that point, a lot of my work can be repurposed, for other uses. Maybe a piece of it can be taken out and used.

So, provided they are attributing it to me, it doesn't matter how they use it. In some cases, they'll even translate it into other languages. Without me even asking. So, I've got lots of my blog posts and other content that I've created is out there now in Spanish and French and German and Chinese and so on, so yeah.

And that's great because I don't have to pay for that. I don't have to ask for it to be done and it just gets done. And that, in a way, amplifies my content and makes it more available to everybody.

So, I think openness, the ability to share things freely, is going to be the future of education.

**Interviewer:** How about the VLE itself, I mean for use… I mean to be used by the universities, to the VLE, do you think that the changes in the future are going to be very incremental?

**Interviewee:** I don't think it will be incremental. In some cases, it will never happen at all.

**Interviewer:** OK.

**Interviewee:** In some cases, it will happen, but it will happen suddenly.

I think it's about leadership. It's also about ownership.

**Interviewer:** OK.

**Interviewee:** It's ownership of content and leadership of systems and those are two different things.

Leadership of systems means that the people who want their own ownership and they want to give away content, they won't go into the systems to use the systems.

So, generally speaking when I share my content with my students, I share it outside of the system. Some of my content is shared inside the system, so inside Moodle I will share content, but that content is almost… that content has almost always been shared before that outside the system. For free. So, in effect I'm sharing it twice. Inside the system where it's closed and not available to anybody other than those who are paying for it. But outside the system to anybody who wants to use it, even if they haven't paid for it.

**Interviewer:** Thank you.

Who are the customers now and in the future? Do you think there will be a change, or…?

**Interviewee:** Well, clearly the customers right now are students.

**Both:** *(laugh)*

**Interviewee:** Students are paying £9000 a year or whatever it is for their tuition fees, Master's students slightly less, PhD students depending on where they come from, slightly more or less. Those students are my customers at the moment. But increasingly I think we will have to work more with business and more with community and more with enterprise to actually… both… to both get our ideas out there and propagated and also to bring people in so that they can become business partners with us. And that might mean research companies, it might mean businesses, it might mean start-up companies. It could be anybody really.

Sometimes students can be both, can't they? They can be a spin-off company.

**Interviewer:** Yeah.

My concern is, what would be the direction for this expansion of customer base? For the professional to begin to, err, you know… For VLEs for the professionals, there are different brands, not Blackboard or those. Blackboard models are mainly for students.

So, how would be the *(inaudible)* direction of this expansion… professionals through to private students…?

**00:16:52**

**Interviewee:** This is a very complex problem, or question.

I think the way I see this is that there are several layers to it. The first layer is that universities, each university will have to choose the direction it's going to go in. So, each university will diversify and they will provide niche products.

So, for instance, one of our niche products here is the Surf Science Technology degree, which is based upon surfing as a sport, but it's also based upon the business aspects of that. It's based upon things like, you know, coastal management and body science and polymer manufacture. There's a whole range of specialities within that hybrid, niche product. And we're the only ones doing that, that I know of, in the world. So, we've cornered the market there.

Every university is going to do that. So, at the top level, I think every University will go off and find its own direction. But underneath that, I see that many businesses and many enterprises and companies outside who want to come to the universities to have a partnership with us, they will be choosing lots of different directions. So, I would consider that it would be rhizomatic, in other words it will have many directions, many layers, many sub-straits and many different possibilities. And I don't think we can predict any of that.

**Interviewer:**

**0:15:12** I just observed that most VLEs are used for the universities, but also in the UK there are many (in?) primary schools and *(inaudible)* institutions beginning to adopt VLEs. So, what is your idea about this trend?

**Interviewee:** The thing about schools adopting VLEs – and most of them go for something like Merlin or Frog – these are tools that we wouldn't use in higher education because they're not designed for that purpose. They're designed for primary and secondary education. But some schools are using Blackboard or Moodle as well now, which is of course the same that we would use in higher ed.

Now, the thing with primary and secondary schools is that they have had this imposed upon them by government.

**Interviewer:** Oh, OK.

**Interviewee:** It's not been something that they have chosen to do, it's something they have HAD to do because the government, the department for education has insisted that they do that.

And so, they use them in a variety of ways. Some of them use them very superficially, others use them in a very deep way. That's very, very varied in terms of how schools use VLEs.

**Interviewer:** What do you think will be the major difference in terms of the features or functionalities of VLEs for either school or university?

**Interviewee:** Well, the prime concern for compulsory education, particularly primary education is child safety. So, e-safety, safeguarding, has become the most important issue for them to address. And that in a way means that they have locked down their systems so that nobody can get in. And that's right to do so.

But they have also locked down the fact that you cannot deliver things like YouTube into the school now, or you know things like Facebook, because they are age-specific and the content on them is sometimes questionable.

That's the main issue I think, whereas in universities you don't find too many services being locked down or locked out. That's the big difference.

**Interviewer:** Oh. This is interesting, so quite obviously they do not ask for special openings.

**Interviewee:** Mmm.

**Interviewer:** Yeah.

**Interviewee:** *(Clears throat)*

**Interviewer:** Which VLE was adopted by your institution and why was it chosen?

**Interviewee:** We used to have something here called SharePoint, which was a Microsoft product which, in my opinion, and in the opinions of lots of my colleagues was not fit for purpose. And we suffered that for many years. And I don't mind going on record as to saying that. You know, several of us have complained consistently about SharePoint not being fit for purpose. It was a very dense, very difficult system to work and many students spent too much time trying to find out how to work it – and staff as well – very difficult to navigate. And therefore, they weren't thinking about learning, they were thinking about finding the content. Which was a big waste of time.

So, SharePoint was a really bad mistake I think. But, we've changed that this year, thankfully, to Moodle. Moodle is a much better tool, it's actually designed for the purpose it's being used for, which is learning and teaching using online tools. And it's a big improvement, and I applaud the leadership of this university for choosing to go that route this year. It should have been done several years ago, but at least it's better late than never.

**Interviewer:** Oh right.

So, how is the decision-making process for VLE procurement – the process I mean about how different VLEs were reviewed to arrive at that selected one, and how does the final decision reflect different stakeholders opinions?

**Interviewee:** Well, we have several faculties here and each faculty has a say in… the committees that are being run. I used to sit on a committee which advised on various tools and technologies that we would use across the university.

Now we have, I suppose, a central unit over there which is the E-learning unit which is headed up by Neil Witt.

His team, I believe, have been instrumental in getting Moodle reinstated really. We used to use Moodle before in fact, many years ago, so we've had it reinstated in that sense. But now is the first time it has been deployed across the whole university. So, his department's had a lot to do with that. You know, in recommending that it be brought across.

But, I think also, TIS which is Technology and Information Services, which is a central team who run and manage the technology for the whole university, they've obviously been involved in the discussion and procurement as well of it.

So, I think several units and several teams have been involved together in bringing us to this point where we now have Moodle rolled out across the whole university.

**Interviewer:** So, what are the criteria you use to assess those different – ?

**Interviewee:** What are the - ?

**Interviewer:** What are the criteria - ?

**Interviewee:** Curricular?

**Interviewer:** What are the standards you use?

**Interviewee:** Standards?

**Interviewer:** You assess different brands…

**Interviewee:** Well, obviously scoring is important. We need interoperability. We need to be concerned about things like, when students bring their own devices in, we need to be able to make sure that it's rendered across all the different tools equally well.

**00:09:47**

So, if they're bringing in an iPad or an iPod touch or an android phone or whatever, they need to be able to have good access to the same content.

One of the problems that we've got with Moodle is that it renders better on Chrome – Google Chrome – as a browser than it does on Microsoft Internet Explorer. So, people who are using Internet Explorer might not be able to see all the content equally well.

So, there are still problems with interoperability, which… But that's one of the standards that you should insist on, I think, for any major roll out in any organisation.

**Interviewer:** Who can I say, Moodle outperformed that brand in terms of…? If… just in terms of interoperability…?

**Interviewee:** The thing about Moodle is that it's constantly evolving because it has got this support community which is worldwide. Moodle is probably the most widely adopted open source tool now for VLEs worldwide.

It's outperforming Blackboard, I believe, because the people who are using it are the people who are designing it. So, generally speaking you have people out there who are coding it all the time, who know what they want and know what their community wants. They have locked into the community.

**Interviewer:** Yeah. OK.

**Interviewee:** Organisations like Blackboard do their best to try and find out what people want, but they are kind of one step removed from it, because they are a company. And therefore, they're only able to do so much with the finite resources they've got. Moodle is much more responsive to change and as new patches and new plugins come out all the time, you can update and upgrade virtually every week.

**00:07:57**

**Interviewer:** Can I ask another question? How does Moodle compare to Desire2Learn?

**Interviewee:** Moodle is the same… I mean… Desire2Learn, I think, have the same problems as Blackboard in as much as they are both proprietary companies, they are both big companies who are trying to make a profit, trying to keep their shareholders happy.

The thing is, they can only respond so often to changes, and so therefore, their update packs only come out every six months or so. And therefore, you have to keep waiting when there's a problem.

**Interviewer:** How about Sakai?

**Interviewee:** Sakai is open source again. Sakai is very similar to Moodle but it's not as big as Moodle. It's not as widely adopted as Moodle. It's got it's own community, just like Moodle has, but it's a smaller community, and therefore, the people who are in Sakai are basically people who are passionate and adherence to it and people who are in Moodle, who are much more generic, I suppose, in their approach. So, it's got a bit of a disadvantage really.

**Interviewer:** Thank you. Thank you very much.

Was the VLE adopted university-wide, and was there already a VLE in place before?

**Interviewee:** Well, we know that there was in place before, I've said that. It was SharePoint, which was a business communications tool, rather than a VLE, so therefore it wasn't really the same, it wasn't really a good thing.

**Interviewer:** So, it was adopted university-wide, right?

**Interviewee:** Yes.

**Interviewer:** So, next question is, what is the version that is currently used and how does it compare to prior versions, and has any aspect been improved or not?

**Interviewee:** I don't know how I can answer that, because the version we've got now, is the only version we've used recently. I've seen previous versions of Moodle and things have improved in terms of things like the grid system, you can put images into it now, which… which you couldn't do before for instance. Which allow you to create

files which students can click on and open up. And there are ways of annotating content and so on, which you couldn't do before.

But generally speaking, I can't really answer that because we haven't had a previous version.

**Interviewer:** Yeah. OK.

So, just from your own experience, you also cannot compare those historical versions of Moodle…?

**00:05:25**

**Interviewee:** Like I've said before it's more graphically based than it was. It's, I think, easier to use in terms of the navigation. And, it's easier to use in terms of how you communicate and how you share content than it used to be.

**Interviewer:** OK. Thank you.

And what are the teaching faculties' feedback in using the selected VLE?

**Interviewee:** The one we're using now… people are much more positive about this. We've only been using it since the start of term, so since August/September time when we started populating the content. But I think everybody here is on board with… in my institute here… and just that everybody that I've spoken to has said it's a vast improvement.

**Interviewer:** Thank you.

What are students' feedback in using the selected VLE?

**Interviewee:** Again, very positive. Most students are using it now. Very few students from this institute actually used the last system because it was so difficult to use. This one is much easier to use; they find things easier and therefore they are more willing to use it.

**Interviewer:** OK. Thank you.

Do you think the selected VLE has been running as expected? Any unexpected issues? Any aspects doing well, and any to improve?

**Interviewee:** I think the Moodle system we're using now has met our expectations. I think one of the problems we've got is with, what's the word we use? We use a kind of…

When there are several groups of students, all studying the same programme, but they have been placed into different files, it's difficult to get them to contact each other. So, they might be in the same year group, they may even be on the same module, but because the module has several different numbers attached to it, they'll be separated from each other, and therefore, we have to then ask for the creation of a meta-site which covers all the other sites and connects them together.

That is unwieldy. I think there should be a better way of allowing related module students to connect to each other. And communicate with each other, without creating a meta-site. That's the big problem which needs to be addressed.

**Interviewer:** Thank you.

Who are the vendors supporting the selected VLE and how do they carry out their supports? How do they respond to the feedback from VLE users?

**Interviewee:** We don't have vendors for Moodle, it's open source.

**Interviewer:** OK. It's how do you say, in-house? How does the in-house team respond to the feedback?

**Interviewee:** We have digital champions, people who are Moodle experts assigned to each faculty. This faculty has two. They work mainly over in TIS, Technology and Information Services, and we can call upon them at any time to help us if we've got issues. And there has been training that has been rolled out for all academic staff prior to us using the system at the beginning of the term.

**Interviewer:** OK. Thank you.

And have you communicated with VLE companies about your expectations of their product and have they responded positively to your communication? Are they making the right trade-offs? Do they have the right competencies for the future?

**Interviewee:** Well, as I said, we don't have vendors for Moodle, so there is no point.

**Interviewer:** Oh, right. So, almost never contact Moodle, the company?

**Interviewee:**

**00:01:28** Moodle isn't a company really. It's a group of people. And, you know, I know people I imagine did actually set up Moodle in the first place, I've worked with them several times. And we can talk to people like him, but generally speaking it's the community that makes the decision on how Moodle goes. It's not something that's sold, it's something that's free and therefore the people who use it are the people who own it.

**Interviewer:**

**00:01:04**

So, I'm interested in the mechanisms of to make a voice in the community. Can I say that because we are so remote and there is numerous institutions, can we make our voice *(inaudible)* as the one? Being the one taken into account?

**Interviewee:** I don't know how to answer that. I'm not sure, because it's not like something that's been bought or sold, it's not a product. It's a tool that is free.

**Interviewer:** I know, but they release different versions to market, so there must be some changes from version to version.

**Interviewee:** Well, that will all come through TIS and through the E-learning department over there and some people who are touched in… actually in-touch with the network, in-touch with the community, they will implement updates as they emerge, I would imagine, as they see fit.

**Interviewer:** I see, thank you.

**00:00:02** OK. This is almost all the interview. Thanks a lot!

## Interview Transcript (3)

| | |
|---|---|
| **Interviewee:** | E-learning director from a Russel Group university in the UK |
| **Interviewer:** | Ye Zhang, PhD student from Plymouth University, UK. |

*** represents anonymized information about the specific institution, workplace or location

**Interviewer:** OK.

Hello. Yeah.

**Interviewee:** OK? Do you want me to introduce myself on the recording as well? Just so you know who I am?

**Interviewer:** That would be great.

**Interviewee:** OK. I'm ***, Head of eLearning at the University of ***

**Interviewer:** OK, thank you very much.

Yeah, okay, so I'll start my interview. The first question is, how long are you working in the area of educational technology, and what is your role?

**Interviewee:** I've been working with educational technology for about 13 years now, in various different roles from starting in a very hands-on developmental role through to where I am now, which is managing a team of learning technologists at the University of ***.

My responsibility now is the strategic development and roll-out of technology across the university. So, at *** we are adopting various technologies and looking at how they will impact on our curriculum and actually help us benefit students. We're looking at student experience, plus obviously developmental work as well.

**Interviewer:** OK, thank you very much.

So, my next question is, what are the VLEs in the market that you know, and how do they differ from each other?

**Interviewee:** So, I guess if you look at the UK and North American market, so the sort of Northern Hemisphere market, there are four main VLE products which are pervasive in that market at the moment.

There are two commercial, and two open source. Blackboard is obviously one of the big commercial products. Design2Learn, which has just rebranded as Brightspace in the last few weeks, both commercial products. Mainly marketed in the North American market at the moment but working much more into Europe and the rest of the world.

And, the two big open source ones are Moodle and Canvas, which is a new entry into the market since about 2010.

**Interviewer:** Oh, right.

**Interviewee:** And, that was developed and rolled out by a company called Instructure.

**Interviewer:** OK.

**00:48:39** Why do you think Desire2Learn is a brand that entered into the market very aggressively and take away a greater size of market shares? Why do you think…?

**Interviewee:** This is Desire2Learn?

**Interviewer:** Yeah.

**Interviewee:** It's difficult to say, I don't know as much about Desire2Learn to be honest with you.

They are a Canadian company which has a very strong presence in Canada. But historically have been looking to expand into the rest of the world.

**Interviewer:** Ah, OK. Yeah.

**Interviewee:** Whether they have or haven't, I don't know to be honest with you.

There's been an awful lot of interesting lawsuits around Desire2Learn and Blackboard historically. So, certainly over the last… certainly five years ago, there was a lot of patent battles around patented technology and VLEs. And, at the… sort of, the source of those were Blackboard and Desire2Learn fighting over a number of patents around different aspects of the technology and the process that they developed around the curriculum that they were promoting through their particular products.

**Interviewer:** Oh, right. Thank you.

So, what is important for a VLE in your view, and what will be important in the future? Who are the customers now and in the future?

Maybe you can go through them one by one?

**Interviewee:** OK. So, what's important for a VLE. A VLE has a number of different tasks, and obviously there's a primary task which is around provision of information, so you could call it a repository of information. Somewhere for academics to store their materials that they're teaching with and make them available to their particular students at that time.

The other thing about VLEs is that they enable us to create a virtual learning experience for students through the tools that they make available, so we can deliver something at a full distance.

There's my colleague walking through the door.

**Both:** *(Laugh)*

**Interviewee:** We can deliver content to students who are remote from somewhere else and they can have a very rich experience. We can deliver assessments through there; we can deliver group work. You can deliver the curriculum through the virtual interface, and that's really why they're important.

The VLE is a mix of different tools, different techniques, different capabilities that you can blend together to effectively create an element of the curriculum or actually deliver your whole curriculum to your students. So, they have a really different use dependent on who is using it. I think it's very difficult to say that a VLE does a particular task. In an institution like ***, the VLE is unique to every academic and how they want to use it for their own teaching. So, that's a critical thing really there.

What will be important in the future, I think is a really interesting question. It's very difficult to necessarily say how it's going to change, but there's market pressures.

So, there's the pressure of the vendors of those systems, or the developers of those systems, and obviously they can shape in a way education by selling it a product that does something in a particular way, or a particular format.

I think for institutions, we're moving to a much more integrated approach to how we provision both the online content and obviously develop our curriculum and that's driven by student experience, certainly in the UK student fees, so student experience, our positions in league tables. And that's sort of driving the expectation of what we want to get out of VLEs.

**Interviewer:** OK.

**Interviewee:** So, students having a lot more control is going to be a big area of VLEs. I think historically they have been a very one-sided experience. So, the institution or the academic would set information up on there and students would digest or receive or look at that information. But there was very little social in there.

**00:44:40** So, there's a really interesting framework called the Community of Inquiry framework that looks at education on three spheres. So, there's the social aspect, the teaching aspect and a cognitive aspect. And if you look across those three domains and VLEs there's an awful lot of scope still to develop the social aspect, and how that content gets shared, how content gets manipulated by students and developed and they can effectively create a personal experience for themselves.

So, I think that's why they're important in the future. They'll give us the platforms to enable that to happen. They'll help academics change the way they teach and we're certainly looking at how that works.

Who are the customers now and in the future?

I guess there's different customers. The customer of the institution, the organisation that's purchasing a product and installing that product. And obviously

those are higher education, further education, school and organisations who are actually buying the products.

That could change in the future and we could move away from a model of purchasing a single product, possibly driven by the cloud technologies that are being rolled out now. And obviously user's digital literacy is becoming a lot higher so we talk in terms of digital literacy and digital fluency. So digital literacy is knowing about something. Digital fluency is then putting it into practice. And, we've got a couple of laptops here and a mobile phone and each of those things is doing something very different and they are using different types of tools and technology.

So, VLEs will need to adopt to that change in technology and the idea that things are cloud-based and content is sharable, and the customer will probably become the institution plus the individual users. It might be that individual users go to a piece of technology that they choose to use, whether that's a VLE or not and actually use that technology because it's something they've personally chosen that they want to use, not something that's been necessarily given to them, or made available by an institution.

**Interviewer:** Oh, right, so… I think in your answer to this question you have just mentioned different stakeholders and the importance of students and… can I ask which stakeholder was most thoroughly reflected in the updates of Moodle, or other VLEs…?

**00:41:55**

**Interviewee:** Erm… I mean the most important stakeholder there is probably the institution because it's the institution that decides when that's going to be… say when an update is rolled out.

**Interviewer:** OK.

**Interviewee:** But. Saying that, equally, we can't make those updates if our users, and that's - there are two key stakeholder groups - there are academics and there are

students that are users, they are effectively the customers of the institution. If they are not willing to have those updates, because they don't want something to change or something to break, or they don't want a function to be removed… and we have to balance the need of each of those stakeholders to make sure that when an update is rolled out, that we can do it functionally at the institution level, we're already… we've got the right facilities in place, the knowledge, that the users know about it, and the students know about it and then it's not going to break any of the functions that they're actually using. It can only get better. We don't want to roll something out that goes backwards.

**Interviewer:** Oh, right. Thank you.

About future customers, apart from higher… Because nowadays most of the users or adopters are from the higher education sector.

**Interviewee:** Mmm.

**Interviewer:**

**00:40:38** So, how about those from primary schools, education, so how would you expect expansion of them…?

**Interviewee:** I think primary education, you know, formal education, is an area that at the moment is an area that doesn't necessarily use virtual technology or virtual learning environments in the same way.

**Interviewer:** OK.

**Interviewee:** My experience of it is, it's very much a face to face curriculum still. It's very much classroom based and there's a number of other challenges around technology being made available to much younger groups of users. It needs to be controlled more.

But saying that, I know a lot of primary schools do have VLEs to support parents, to support homework, to help students look at additional materials. So, I think it's probably an area that is untapped at the moment. There's a possible growth there. And, I don't know, I haven't seen a provider yet aggressively go into that market in terms of virtual learning.

**Interviewer:** OK. Thank you very much.

The next question is, which VLE was adopted by your institute and why was it chosen?

**Interviewee:** So, we have adopted Moodle. We've been there… We've been using Moodle for about six years now, five or six years. And it was chosen after an extensive market review looking at the products in the market place against a series of criteria that we set as requirements in the institution.

But the decision to actually move to Moodle was led by our academics, not by management. So, we were very much led by the need of the academics within the institution and their requirements to support their particular subjects and the teaching and the curriculum that we had at that time. Moodle met those requirements to a greater amount than any of the other products available in the market place at that time.

**Interviewer:** Thank you.

My fifth question is, how is the decision-making process for VLE procurement, how are different VLEs reviewed to arrive at the selected VLE? How did the final decision reflect different stakeholders' opinions?

**Interviewee:** Ok, so the process for making a decision around the procurement process was, as I said, led by our academics.

**Interviewer:** OK.

**Interviewee:** And so, we had a number of different groups of users, the stakeholders who reviewed the products. But ultimately, the review was weighted in such a way that the academic opinion had much higher impact on that decision-making process than possibly you would see another decisions. And obviously that's because this is a product that has to support the academics more than it does the institution, or say IT.

**Interviewer:** OK.

**Interviewee:** So, we reviewed all of the VLEs on the market at that time. We actively played with them, we gave them to academics, they reviewed them, we interviewed company. We had product demonstrations for them. We had a set of criteria that they used to actually make that decision against.

**Interviewer:** Yeah.

**Interviewee:** Financial decision was not the driver, which was really interesting, because normally you'd have a financial constraint on it. But we didn't actually release any financial data to anyone on that review panel until after the decision was made, and then we reviewed financial impacts of that.

**Interviewer:** Oh, right.

So, what are the important… you just said financial… is not a decision to be made financially… so what are the factors?

**Interviewee:** The factors were really around the curriculum...

**Interviewer:** Curriculum?

**Interviewee:** …against a set of curriculum-based requirements to actually ensure that any product chosen actually could deliver the curriculum that we articulated through a set of criteria that were pulled together by that academic group.

**Interviewer:** OK. In terms of functionality, I think there are a lot of similarities between nowadays between different VLEs. So, is there any particular product features or functionalities make you prefer Moodle or…?

**00:35:54**

**Interviewee:** To be honest, there's not a lot of difference. All the VLEs virtually provide the same thing. They all have the same tools; they all have the same functions. They just describe them in a very different way. And they have a different workflow on them.

But, really when you look at VLEs they're all offering very similar things, it's just that the workflow and the presentation of that may fit a different form of curriculum. A different form of pedagogy that may fit better with it.

**Interviewer:** You mean the workflow…?

**Interviewee:** Yeah, could be workflow, it could be the pedagogy, so the actual theory of education that we want to adopt. So, Moodle I know is a social constructionist model of learning. Or a form of, it's not perfect. Other VLEs would describe themselves as probably agnostic, where they would say actually you could do anything with our product because we're not fixed to a particular pedagogy.

**00:35:08**

So, yeah. Ultimately, if you look at the core functions of a VLE and the tools they offer, they're all pretty much the same.

**Interviewer:** Oh, right.

**Interviewee:** There's very little separating them. There's no one product that has an edge on another because it has a particular tool in there.

**Interviewer:** Oh, OK.

So, your faculty members just preferred Moodle?

**Interviewee:** At that time when we did that review, yep, their choice and their preference was that Moodle was the product at the time which fitted their needs, across our curriculum, from all of our different subjects and were much stronger than any of our other products available at that time.

**Interviewer:** What were you using before Moodle at *** University?

**Interviewee:** We had a system called WebCT before Moodle.

**Interviewer:** Ah. WebCT.

**Interviewee:** Which is now part of the Blackboard family.

**Interviewer:** Blackboard.

**Interviewee:** Yes.

**Interviewer:** So, what was the reason you decided to switch from that one to Moodle?

**Interviewee:** It was end of product life actually. The WebCT product was ending, so we either had to… they were bought out by Blackboard, so at that time you either had to move from WebCT onto the full Blackboard product or you moved to an alternative product. So, that was really the driver for it… that initiated that review, that need to move products because the one we had was ending.

**Interviewer:** Oh, right. Thank you.

My sixth question. Was the VLE adopted university wide and was there already a VLE in place before?

**Interviewee:** So, yes, it has been adopted university wide. 100% of taught students at the university receive content through the VLE. And there was a VLE beforehand, that was WebCT. It wasn't as well adopted actually. Partly because the technology wasn't being developed, because obviously the product didn't exist at that point. But we do now have 100% adoption for taught programmes.

**Interviewer:** Ah, right. Thank you.

My next question. So, what is the version that is currently used, and how does it compare to prior versions? Any aspects have been improved or not?

**Interviewee:** So, we're currently using version 2.4 of Moodle, I believe.

It's… how does it compare to prior versions…? It's got better in part, but I wouldn't say it has dramatically improved since we had it.

There's been a lot of redevelopment of Moodle. And, the development model that Moodle uses has been changed from a very ad-hoc, sort of "released when they've got a product" to a much more robust model where there are two version releases per year.

**00:31:53**

**Interviewer:** Yeah.

**Interviewee:** So, I think they are May and November, something like that, I can't remember the actual dates.

So, there is now a much more formalised product, we can plan ahead, we know when those releases will happen, and there's a much better set of documentation with that release to say what has been changed or what's been improved or what's new or what no longer exists. So, that has certainly become much better.

Saying that, there are still some bugs with Moodle, bugbears, or challenges that we face in that it still adopts a very rigid way of presenting information. It's a very linear presentation style.

**Interviewer:** OK.

**Interviewee:** …that a course is made up of topics, or on a weekly basis, of a number of sections and those sections are very linear. So, for some staff that can be a very challenging way of presenting information. And that bit hasn't been improved yet, that's still as it was when we launched six years ago.

**Interviewer:** OK.

So, what other versions, because the present version is 2.4 I think…

**Interviewee:** Erm… 2.6 I think is the current one. We're on 2.4.

**Interviewer:** Yeah, I mean the one presently adopted by the university…

**Interviewee:** Oh, right, yes.

**Interviewer:** 2.4 so, what are the previous versions? 2.1 or…?

**Interviewee:** That we've used here? We've had 2.0… if we start back, we were on 1.9. something, and went to 2.0 and 2.2 and 2.4 currently.

**Interviewer:** 2.4, ah, OK.

Why not you progress into 2.6?

**Interviewee:** So, we, erm… actually outsource our Moodle hosting, so we have an external hosting partner. And so, we are restricted by the version that they offer. So, they on a once-a-year basis do an upgrade and they offer the version which is the most stable version and been adopted by them at that point. So, that decision is very much taken out of our hands as an institution because obviously we outsource the hosting of it.

**Interviewer:** Yeah.

So, from version to version, as you mentioned, you didn't see much improvement?

**Interviewee:** There's been changes between 1.9 and 2.0 there were some real fundamental changes to, I guess, the infrastructure of the system. So, it moved to a much more database driven infrastructure, so that was a real fundamental change. So, it changed a lot around file management. It changed a lot around system stability, system architecture changed. The tools on top of that, so, for most users, the thing that really changed for them was file management. It changed away from a flat-file storage system in 1.9 to version 2 having a database file storage system where a file can only exist if the host item still is maintained within the course it's being put into.

If, for example, you had… I don't know… a discussion forum and there was a file associated with something that's been posted, if the discussion forum is deleted now, the file would be deleted. Whereas in previous versions, the files still exist in your system but won't be linked to anything. So, there's been some real key changes there.

Assessment, online assessment, online quizzes, online exam functionality has been improved greatly. That's got a lot better. There's been a lot more thought behind things like online submission, so online submission of coursework into Moodle has improved, certainly in the last version that has improved amazingly. With much more thought around workflow and how you are actually going to do that and giving feedback to students. Those things have all become a lot better.

**Interviewer:** Oh, right.

So, are the improvements, are the outcomes of the responses to students or to faculty members, or just some of these improvements are made by Moodle themselves? And actually, are not a direct response from ***?

**00:27:23**

**Interviewee:** No. So, yeah, the improvements we've had have come through from the product. So, I guess the group of people developing that product have made those

decisions and are in many ways… they get imposed on us. And this comes back to my point earlier about when we do an upgrade is, we also have to make a decision to say, “Is that upgrade appropriate for us?” and, “Is that going to give us an improvement over something, or actually make it worse?” Which does sometimes happen. Some of the functionality can be perceived as worse than they have already.

**Interviewer:** This is a very interesting aspect. Can I explore more in this regard?

**00:26:34** So, what are the particular improvements you think is not of benefit of ***?

**Interviewee:** So, we could erm… Integration with third-party tools, sometimes gets a lot worse. Between Moodle 1.9 and 2.0 versions they moved away from how integration worked before into an API based model.

**Interviewer:** Yeah.

**Interviewee:** And obviously a lot of people had done a lot of customisation with Moodle using the old version and everything had to be rewritten, so there’s a lot of challenges then around, can you still provide the same service, the same integration, same effect there?

Other things that have got worse, things like wikis in Moodle, the wiki functionality is appalling, it is dreadful. It used to be very good, but it’s never improved. And so, now, you have effectively a new wiki but actually provides something that’s much worse than something we had in the “1” versions of that product. So, again that’s been improved, but it’s actually made it worse, so it’s not as good.

**Interviewer:** Oh, thank you.

Can I just know… what particular reason… what specifics with the improvement that to be made worse by faculty member? How is that improved but well, worse?

**00:25:11**

**Interviewee:** Erm… so I think for academics, if they can't do something the same, that's worse.

*(laughs)*

So, if they've been teaching using a particular tool and then we do an upgrade and then that tool doesn't do the same thing as that particular member of staff needs, then that's perceived as a worse element. So, it's a backward step for them.

So, if you scale that up across the size of an institution, if there's a number of people using that for their teaching and all of a sudden you can't do that, or the tool doesn't exist, or the tool no longer has that function in, that's a retrospectively bad step for them. It would be seen as…

**Interviewer:** Oh right.

**Interviewee:** … an inappropriate upgrade.

**Interviewer:** Are there any particular aspects that have improved constantly well that have been found very positively by the faculty members?

**00:24:17**

**Interviewee:** If you look at Moodle, assessment is getting better. So, every element of assessment from online exams, online quizzes, formative feedback, diagnostic feedback through to submission of coursework and submission of a file electronically. That aspect of it, certainly in the last two years, has got consistently better. And it's quite apparent that those improvements have been driven by a very close working with academics who are really modelling what it is that need to happen to get better.

So, the workflow's got better, the visual display has got better. The user experience has got better on each of those aspects, and it's been quite dramatic how they've pulled that into production.

**Interviewer:** Yeah. Thank you.

So, the next question is, what are teaching faculties' feedback in using the selected VLE?

**Interviewee:** Ahh… Feedback on the whole is very positive. We have, as I say, universal adoption of 100% taught modules or the university programmes that use the VLE. And, staff are very happy with what they can do.

But, you've probably got 10% of our users who are always fed up because they want to do something greater than the system provides.

We've probably then got 80% of our users who are very content and they will use the system because it provides everything they want and it makes their life easier.

And then we will have 10% who are always unhappy and not wanting to engage with it, probably because they're never going to engage with any VLE system regardless of what the product is.

**Interviewer:** Yeah.

**Interviewee:** And if you look at it on that basis, that's sort of where with systems if you ask for feedback, you sort of get that breakdown.

**Interviewer:** OK.

So…

**Interviewee:** *(Coughs)*

**Interviewer:**

**00:22:01** … is there any other reasons for Moodle to be adopted? Any change that happened to the feedback except as the proportions you say?

**Interviewee:** Not that we've seen. I think the adoption of Moodle has been very successful here because it's so easy.

**Interviewer:** Yeah, yeah.

**Interviewee:** You don't have to go on a training course, it take 10 minutes to understand how to work it. And that ease of access and that ease of use on it, has actually driven the take-up levels.

When you then look at how you need to supply support for it, the level of support hasn't changed with greater adoption. Because it's a very simple system, so the system itself lends itself to very simple adoption. You know, it's just been designed to be easy to get into, easy to understand.

So, that's I think driven users to it. We haven't had a lot of negative feedback. We don't have a lot of frustrated users who are trying to do things that much greater and above.

But where someone does want to do something that is not the norm with Moodle, you can find a way of doing it. You can generally go in and help them…

**Interviewer:** OK.

**Interviewee:** … and find a solution for them.

**Interviewer:** Have any significant change made as a response to the faculty members…?

**Interviewee:**

**00:20:46** Internally no, not particularly. So, we are slightly restricted because we're outsourced, we don't have access to the system to make changes ourselves, so we can't just say, "Let's go and get a plugin and put it on the system and do it." Because we have a commercial contract in place. We operate in a slightly different way.

I think if you hosted it internally, yes there's an awful lot more you could do, you could customise it, you could integrate in a lot more depth than perhaps we have in some areas. But on the whole, we provide a fairly basic Moodle platform and users are very happy.

**Interviewer:** OK. So, tell me, when you collect feedback from the users, but because you are outsourced and externally hosted, you cannot get the feedback to the company?

**00:19:47**

**Interviewee:** Yep. So, we work very closely with the external company and if we identify a significant issue that needs addressing, we would then pass that over to them. Whether it's technical or system related.

**Interviewer:** Oh, right.

**Interviewee:** And they would have to fix that as part of our contract with them.

**Interviewer:** Oh, right, thank you.

So, the next question is, what are the students' feedback to the selected VLE?

**Interviewee:** Well, the students… Yeah… Student feedback again, it's predominantly happy. They use the system. We have students on the system 24 hours a day, every day of the year, so 365 days of the year there are students on the system, using it, accessing content, interacting with the materials.

And they have… Again, there is some frustration around the simplicity of the interface, so we kind of look pretty awful unless you spend a lot of money on visually adopting it. But on the whole, students find it incredibly useful to use the system and actually have their materials there. We have very good, positive feedback.

**Interviewer:** OK. Because you just mentioned, also I think why Moodle has had such a success because its very easy to use in a place.

**Interviewee:** Yes.

**Interviewer:** Can I ask how does the interface compare with Blackboard, or Desire2Learn? Especially, I don't know, maybe several years ago they make it not as good as those, how Blackboard and Desire2Learn have improved in this area?

**00:18:00**

**Interviewee:** Right. It's difficult to say, because I don't have a lot of knowledge of Blackboard and Desire2Learn at the moment, where they are at the moment.

**Interviewer:** OK.

**Interviewee:** What I have seen, I think the more commercial products have put a lot more emphasis into user interface design than Moodle has as a product. And, I think that's more indicative of being a commercial product, and they probably have a very different development ethos around what the product they're actually selling.

So, I think visual interface has been developed much better in Blackboard and Desire2Learn than other products and perhaps Moodle have done. Moodle are very much, you have to develop that yourself through the development of the templates, but there are still quite significant limitations in how you can actually do that. The templates themselves don't necessarily give you a lot of visual scope. Whereas other products are visually designed as part of their design process.

**Interviewer:** Oh, right.

**Interviewee:** Does that make sense?

**Interviewer:** OK, so. I leave that aspect and its hard to… I mean it allow… it's very costly to switch to one version to another, but if there were a way you could lower the cost of changing, of switching from one to another, do you think it would be very difficult for the faculty members to choose which one they should go for?

**00:16:28**

**Interviewee:** I think it could be, I think you have to have an acceptance to change. And there has to be a very compelling reason to make that change.

**Interviewer:** OK.

**Interviewee:** And identifying those compelling reasons are… it becomes more challenging when people are fully adopted to a technology. Erm… you have to actually identify a benefit, there has to be an intrinsic benefit of that particular move – a cost benefit effectively. So, if we move from product A to product B, it has to do the same thing. So, effectively it has to duplicate those core functions, but it has to add something so new, that we cannot duplicate in any other way with the existing platform. And that particular selling… that particular function is a way of then selling that change to others.

Unless you can do that, I don't think you can make that change easily. You can replicate a product, but it doesn't necessarily mean that users are happy with that change.

**Interviewer:** OK. What are the costs, if change were to happen?

**Interviewee:** The cost of it? Well, you have a financial cost of the product, so you have the capital cost, how much is it going to cost us? You have the cost of migration. So, moving all of your content from a system to a new system is challenging. It doesn't necessarily translate or automate automatically and we've found that previously. So, you have to think about, "How do we change the content to make it work in the new platform?" Give it a workflow that's now been deployed, there's a cost associated with that.

**00:15:00**

You've got the staff cost. How many people have to be involved with that particular change? Get new staff in. And then all of those things come together as, I guess, the opportunity cost of it, the value to the institution of that particular change. And the opportunity that offers us is then the value we add with that particular new platform.

**Interviewer:** Thank you. Thank you very much.

Do you think the selected VLE has been running as expected? Any unexpected issues? Any aspects doing well? Any to improve?

**Interviewee:** It has been running as expected. It's run actually very well over the last five years. We've had some down time as you do with all systems but that's been addressed. Overall, the user experience has been OK. A lot of the issues we have had have been internally; networking issues, where the network's gone down, or unexpected external factors at the hosting institution where they… you know… the network could have failed or…

**Interviewer:** Ah, OK.

**Interviewee:** You know, an element of the system failed. Erm… I guess you can always work on improving uptime, improving user experience from that perception that it's unavailable, so how do you get around that? Can we have, you know, remote fail oversight? So, geographically locate it in different places. Can you make the service have a better uptime? There are aspects there we can look at. But effectively, you know, it's run very well.

**Interviewer:** According to your feedback, is it still a very small proportion of people that firstly complain against certain aspects, what other aspect has been complained about?

**00:13:03**

**Interviewee:** So, for our users I think the complaints have been around the inability to be flexible with Moodle. And I guess that they know that Moodle can be expanded by finding plugins that an individual's written.

Obviously when you run the system at an enterprise level you have to approach those plugins in a very different way. So, we generally wouldn't just get them and put them on there. Because obviously they have to be supported, they have to have code that's been reviewed, they have to have a development cycle to keep them up to date with new platforms.

So, we are quite strict on what we do or don't roll out with the platform and that does cause a lot of frustration for staff who see Moodle, who can store Moodle on their own server, on their own computer and have a play with it, and they know they can modify it to make it do something unique for them.

**Interviewer:** Yeah.

**Interviewee:** But obviously, if you then duplicate that across an enterprise platform, that particular customisation may not be appropriate for 95% of the users.

**Interviewer:** Ah, right.

**00:11:59** Do you think it's something to do with scalability of the …?

**Interviewee:** Part of it is scalability. Moodle doesn't scale as well as other enterprise level platforms. Yeah. It's… I'm guessing when it was designed, it wasn't designed to be run at such large-scale levels that institutions use it now. You know, for a smaller installation with less courses, with less complexity, with less users. So, when you do run it at a very large scale, I guess there are more challenges.

**Interviewer:** Oh, right. Thank you.

So, who are the vendors supporting the selected VLE and how do they carry out their support? How do they respond to the feedback from VLE users?

**Interviewee:**

**00:10:53** Erm… so, I guess with Moodle, it's because it's an open source product, it's governed by, I think they're called the Moodle HQ, which is an Australian… I believe?

**Interviewer:** Yeah, yeah.

**Interviewee:** Erm… And they gather the feedback from all Moodle users around the world and try and drive the development platforms, so now they're much more driven. They have two release dates a year. They are looking at those improvements.

So, they will… And I guess, if we as an institution wanted to influence that, we could go through and influence them to make a particular change, and we'd have to put our case forward. I guess we could to influence it even more, pay for that change to be developed. So, we could develop it, and then give it back to them, or ask them to develop it and put that into their platform vision.

**Interviewer:** How about your external host company?

**Interviewee:** The hosting company for us, could also do that. We… So, we could ask them to develop something very bespoke for us and adopt it and develop it. Which is an option with Moodle, we could do what we want. The downside of that is the more custom functionality you make, the more risk it breaks when the main Moodle system upgrades. If it isn't written in an appropriate way, that development could become unusable.

**Interviewer:** OK.

**Interviewee:** If Moodle changes something core. So, I guess moving from 1.9 to version 2 they got rid of the integration methodologies and developed a new set of APIs. So, anything from previous to version 2 would have to be redeveloped around those APIs to make them work.

**Interviewer:** Oh, right.

**00:09:02** OK. So, what are… the next question… what is normally the support from the external hosting company to *** University.

**Interviewee:** What level of support?

**Interviewer:** Yeah.

**Interviewee:** Erm… We would meet with them as regularly as we need to. So, if we have any issues we'd address it, we'd have lots of phone conferences with them. We have a number of planned meetings with them every year where we'll review things, look at data, look at performance, look at our needs, our growth, our development. And they would look at that around the management of the service.

**Interviewer:** Ah, right.

As you mentioned before that, generally the feedback from either faculty members or students is very positive…

**Interviewee:** Mmm-hmm.

**Interviewer:** So, that leads me that those meetings are just as a routine.

**Interviewee:** Yeah. Quite right. They're just routine. So, we're looking at our growth, growth in use of the system and additional storage we may need, or associated bandwidth. Reviewing the performance of the system with greater use of it and greater requirements on it. So, it becomes quite a routine meeting.

**Interviewer:** Oh, right. Thank you.

OK. Let's go on to the next question, it is; have you communicated with VLE companies about your expectation of the product? Have they responded positively to your communication and are they making the right trade-offs? Do they have the right competencies for the future?

I guess much of this question has been answered before… Is there any…?

**Interviewee:** Erm… yeah.

**Interviewer:** Is there anything you could add?

**Interviewee:** It's interesting, "…do they have the right competencies for the future?"

**Interviewer:** Yeah.

**Interviewee:** And that's a really interesting area. Because obviously, it really depends on their acknowledgement and awareness of where education is developing. And a lot of that is political, so where funding comes from.

**Interviewer:** OK.

**Interviewee:** What is it that institutions are being asked to do by their particular countries or governments? And that issue of competency is; do, they have they have the right skillset and the right staff in place and the right awareness of how education develops to then develop the product is a really challenging one. Because it's a very difficult area to guess.

**Interviewer:** Yeah. I think so as well.

**Interviewee:** Incredibly challenging. I think they have a very difficult job. And I know because we actually have lots of the companies come and talk to us, and those companies are forever going into institutions to understand what's going on. To understand the challenges, the drivers, the decision-making process, the strategies. Looking at our five-year strategies for education institutions to actually help them build their business models.

**Interviewer:** Yeah. Perhaps I should say it from your talking that, first, your first problem is how do they confine to us, a small fraction of people in ***, to select your feedback. For those feedbacks to actually reach the Moodle HQ, do you think you were to realise this? Do you think…? What kind of competencies do Moodle need to…?

**00:05:49**

**Interviewee:** I think Moodle is quite interesting in its model, because obviously they have different developers from different countries working with them, and that model enables them to tap into the political direction. And, I guess the educational direction from individual countries.

So, if someone from the UK were to work with them, they intrinsically know the challenges in the UK market as opposed to somebody perhaps from India who has a very different set of challenges.

So, Moodle's got an interesting model because I know they second people in for particular development tasks to Moodle HQ to help with developments to address those issues. So, I guess that's an interesting model. I guess with commercial companies it's difficult for them to be that agile. They can't just say, "Come and work with us for six months and do this." I guess they have to employ people and they have different financial drivers, different marketing goals, which are money-driven as opposed to Moodle, which has no money or financial drivers behind it.

**Interviewer:** OK. Financial drivers?

**Interviewee:** Yeah. Because Moodle is an open source product it isn't driven by…

**Interviewer:** Yeah, yeah…

**Interviewee:** … selling. Whereas a commercial product they have to sell a certain number of licences for that product to, I guess fulfil shareholders and the funders.

**Interviewer:**

**00:04:27** Yeah. Moodle do have a business model to survive. I mean they will normally charge a fee from Moodle partners…

**Interviewee:** Yep.

**Interviewer:** I mean, they will normally charge a fee from Moodle partners, although…

**Interviewee:** Yep.

**Interviewer:** … I think you're… the external hosting company of *** is the Moodle partner, right?

**Interviewee:** Err… probably.

**Both:** *(laugh)*

**Interviewee:** I don't know. It could well be!

**Interviewer:** Yeah. It could well… OK, alright.

So, OK, and let's move on to the next question. Is there anything more you could add and are there other people that you know that could contribute to this study?

**Interviewee:** I don't think there is anything else I would like to add.

Are there people I know? Yeah, I think other members of staff in UK universities, in my equivalent role would help.

**Interviewer:** Yeah.

**Interviewee:** Have you thought about contacting HELF, which is the Heads of eLearning Forum?

**Interviewer:** Err…sorry?

**Interviewee:** So, HELF –

**Interviewer:** HELF?

**Interviewee:** So, there's an organisation called Heads of eLearning Forum, which is a UK-based… err… group, I guess. Of all the Heads of eLearning. And that would be a good opportunity, you'd be able to maybe send a message out to that group.

There is a webpage somewhere.

Oh, this laptop's gone off. If you look… so, HELF, Heads of eLearning Forum. But they'd be good to contact, and that would put you in contact with…

**Interviewer:** OK, I will check it out, thank you.

*(Pause)*

**Interviewee:** But yeah, try and have a chat with them and that would give you access to other people who may be happy to talk.

**Interviewer:** Thank you. Just according to what you said before, I do have an interest in one particular point. It's the conversion from WebCT to Moodle.

**Interviewee:** Yeah.

**Interviewer:** Surely, as WebCT was incorporated into Blackboard, there should be a very natural progression to using Blackboard's system. Why, at the time, did all those faculty members just prefer Moodle?

**Interviewee:** Yeah.

**Interviewer:** There may be a lot of reasons.

**Interviewee:** There's a… I think you need to read a lot of… There's a lot of political reasons around it. The takeover of WebCT was handled badly, the Blackboard takeover was not handled as well as they could do, around communication.

**Interviewer:** OK.

**Interviewee:** The product was effectively stopped and you were told, "You will be on this." It was financial uplift, a HUGE amount of additional costs associated with the new licences for Blackboard that were… needed to be explored and then obviously needed to find funding for. So, when you put all of those things together, and you review the market place, yes there is a natural progression from WebCT into Blackboard, but actually it was a good opportunity for the institution to review politically what platform we wanted. And it allowed the institution to identify a product that met the needs against the curriculum criteria, much more closely. I think if you just adopt a new product, it might not be the best product for you at that time. And Blackboard at that time, wasn't seen to be the best move based on all of those criteria.

**Interviewer:** Oh, right. Thank you.

**Interviewee:** So, yeah. It was a good question!

**Both:** *(Laugh)*

**Interviewer:** Thank you. Thank you very much.

**Interviewee:** That's fine, a pleasure.

**Interviewer:** Thank you, I'll stop it here.

**Interviewee:** Good.

You know, contact HELF and the chair of it is a gentleman called Neil Ringham from Manchester Metropolitan University.

### 8.2. Interview Guides

## Interview Guide with Virtual Learning Environment Institutional Adopters

### I. Background information:

| | |
|---|---|
| Archival: | |
| Site: | |
| Interviewee (name, department, job title and responsibilities): | |
| VLE Adoption Context (which & when VLE were adopted ): | |
| Duration: | |
| Date: | |

### II. Interview setting-up

- ✓ Greet the participant in a friendly manner to begin establishing positive rapport.
- ✓ Briefly describe the steps of the interview process (informed consent, question and answer).
- ✓ Obtain informed consent.
- ✓ Turn on the tape recorder and verify that it is working

### III. Question-asking phase of the interview:

*1) How long are you working in the area of educational technology and what is your role?*

*2) What are the major VLE’s in the market that you know and how do they differ from each other?*

*3) What is important for a VLE in your view? What will be important in the future? Who are the customers now and in the future?*

*4) Which VLE was adopted by your institute and why was it was chosen?*

*5) How’s the decision-making process for VLE procurement? (How were different VLE reviewed to arrive at the selected VLE? How did the final decision reflect different stakeholders’ opinion?)*

*6) Was the VLE adopted university wide? And, was there already a VLE in place before?*

*7) What is the version that is currently used? How does it compare to prior versions? Any aspects have been improved or not? (Zoom in on areas where VLE firm consistently improves and upgrades occur and what the impact is on value for users).*

*8) What are teaching faculties’ feedback in suing the selected VLE?*

*9) What are students’ feedback in using the selected VLE?*

*10) Do you think the selected VLE has been running as expected? (Any unexpected issues? Any aspects are doing well? Any to improve?)*

*11) Who are the vendors supporting the selected VLE and how do they carry out their supports? How do they respond to feedback from VLE users?*

*12) Have you communicated with VLE companies about your expectations of their products and have they responded positively to your communication? Are they making the right trade-offs? Do they have the right competences for the future?*

*13) Is there anything more you would like to add? Are there other people that you know that could contribute to this study?*

## IV. Closing interview：

- ✓ Give the participant the opportunity to ask questions.
- ✓ Reconfirm the participant’ s consent while the tape recorder is still on.
- ✓ Turn off the tape recorder and thank the participant.
- ✓ Clarify any factual errors expressed by participants during the interview.

## Interview Guide for students using Virtual Learning Environment

### I. Background information:

| | |
|---|---|
| Archival: | |
| Interview Venue: | |
| Interviewee (name, department & title – **Confidentiality Will Be Kept**): | |
| VLE Adoption Context (which, when & how VLE were adopted ): | |
| Interview Duration: | |
| Date: | |

### II. Interview setting-up

✓ Greet the participant in a friendly manner to begin establishing positive rapport.

- ✓ Briefly describe the steps of the interview process (informed consent, question and answer).
- ✓ Obtain informed consent.
- ✓ Turn on the tape recorder and verify that it is working

**III. Question-asking phase of the interview:**

1) *What is your role in using Virtual Learning Environment (or Learning Management System)?*
2) *Which VLE was ever adopted by you and what are the advantages and disadvantages of using the VLE?*
3) *What are the features of VLE ever used by you? Which of the features are used most often? Which of the features you use only in a few occasions? which of the features you find too inconvenient to use? Which of the features you find that you never use because they are irrelevant to you?*
4) *What is the version that is currently used? How does it compare to prior versions if you ever went through any version updates? Any aspects have been improved or not? (Zoom in on areas where VLE firm consistently improves and upgrades occur and what the impact is on value for users).*
5) *Have you ever learned about any other students' feedback in using the selected VLE?*
6) *Can you compare the VLE ever used by you against metrics like Functionality, Reliability and Convenience?*
7) *Are there any particular features you like most about your VLE? Any features you hate most about your VLE?*
8) *What other features you would like for the future VLE to involve?*

9) *Is there anything more you would like to add? Are there other people that you know that could contribute to this study?*

**IV. Closing interview：**

✓ Give the participant the opportunity to ask questions.

✓ Reconfirm the participant’s consent while the tape recorder is still on.

✓ Turn off the tape recorder and thank the participant.

✓ Clarify any factual errors expressed by participants during the interview.

# Informed Consent Form

**Purpose of the Study**

This study intends to provide a better understanding of the phenomenon regarding firms' persistent emphasis and improvement on certain product attributes. The primary research question that will guide this study is: What are the antecedents and consequences of persistently improving certain product attributes? The conclusions to the research question will be based on the data sourced from the market for the Virtual Learning Environment.

**Subject's Understanding**

- I agree to participate in this study that I understand will be submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Plymouth University, UK.
- I understand that my participation is voluntary.
- I understand that all data collected will be limited to this use or other research-related usage as authorized by Plymouth University.

- I understand that I will not be identified by name in the final product.

- I am aware that all records will be kept confidential in the secure possession of the researcher.

- I acknowledge that the contact information of the researcher and his supervisor have been made available to me along with a duplicate copy of this consent form.

- I understand that the data I will provide are not be used to evaluate my performance as a professional in any way.

- I understand that I may withdraw from the study at any time with no adverse repercussions.

Subject's Full Name: _____

Date Signed: _____

**Researcher's Information:** **Researcher's Supervisory Team:**

Name: Ye Zhang Prof. Mark Leenders: mark.leenders@plymouth.ac.uk

Email: ye.zhang@plymouth.ac.uk Prof. Phil Megicks: phil.megicks@plymouth.ac.uk

Institution: Plymouth University Dr. Jonathan Moizer: jonathan.moizer@plymouth.ac.uk

## Interview Guide with teaching faculty using Virtual Learning Environment

### I. Background information:

| | |
|---|---|
| Archival: | |
| Interview Venue: | |
| Interviewee (name, department, job title – **Confidentiality Will Be Kept**): | |
| VLE Adoption Context (which, when & how VLE were adopted ): | |
| Duration: | |
| Date: | |

### II. Interview setting-up

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- ✓ Briefly describe the steps of the interview process (informed consent, question and answer).
- ✓ Obtain informed consent.
- ✓ Turn on the tape recorder and verify that it is working

**III. Question-asking phase of the interview:**

*1) What is your role in using Virtual Learning Environment (or Learning Management System)?*

*2) What are the VLE's in the market that you know and how do they differ from each other?*

*3) What is important for a VLE in your view? What will be important in the future?*

*4) Which VLE was ever adopted by you and what are the advantages and disadvantages of using the VLE?*

*5) How's your participation in the decision-making process for VLE procurement? (How were different VLE reviewed to arrive at the selected VLE? How did the final decision reflect your opinion?)*

*6) Was the VLE adopted university wide? And, was there already a VLE in place before?*

*7) What is the version that is currently used? How does it compare to prior versions if you ever went through any version updates? Any aspects have been improved or not? (Zoom in on areas where VLE firm consistently improves and upgrades occur and what the impact is on value for users).*

*8) What are other teaching faculties' feedback in suing the selected VLE?*

*9) What are students' feedback in using the selected VLE?*

*10) Do you think the selected VLE has been running as expected? (Any unexpected issues? Any aspects are doing well? Any to improve?)*

*12) Have you communicated with VLE companies about your expectations of their products and have they responded positively to your communication? Are they making the right trade-offs? Do you think they have the right competences for the future?*

*13）What are the features of VLE ever used by you? Which of the features are used most often? Which of the features you use only in a few occasions? which of the features you find too inconvenient to use? Which of the features you find that you never use because they are irrelevant to you?*

*14) Is there anything more you would like to add? Are there other people that you know that could contribute to this study?*

**IV. Closing interview：**

✓ Give the participant the opportunity to ask questions.

✓ Reconfirm the participant's consent while the tape recorder is still on.

✓ Turn off the tape recorder and thank the participant.

✓ Clarify any factual errors expressed by participants during the interview.

# Informed Consent Form

**Purpose of the Study**

This study intends to provide a better understanding of the phenomenon regarding firms' persistent emphasis and improvement on certain product attributes. The primary research question that will guide this study is: What are the antecedents and consequences of persistently improving certain product attributes? The conclusions to the research question will be based on the data sourced from the market for the Virtual Learning Environment.

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- I understand that I may withdraw from the study at any time with no adverse repercussions.

Subject's Full Name: _____

Date Signed: _____

**Researcher's Information:** **Researcher's Supervisory Team:**

Name: Ye Zhang Prof. Mark Leenders: mark.leenders@plymouth.ac.uk

Email: ye.zhang@plymouth.ac.uk Prof. Phil Megicks: phil.megicks@plymouth.ac.uk

Institution: Plymouth University Dr. Jonathan Moizer: jonathan.moizer@plymouth.ac.uk

## Interview Guide with Companies Offering Virtual Learning Environment

### I. Background information:

| | |
|---|---|
| Archival: | |
| Site: | |
| Interviewee (name, department, job title and responsibilities): | |
| Duration: | |
| Date: | |

### II. Interview setting-up

- ✓ Greet the participant in a friendly manner to begin establishing positive rapport.
- ✓ Briefly describe the steps of the interview process (informed consent, question and answer).
- ✓ Obtain informed consent.
- ✓ Turn on the tape recorder and verify that it is working

### III. Question-asking phase of the interview:

1) *What is a VLE in your view?*
2) *How is the R&D organized in your organization? How is R&D linked to marketing and service?*

3) *What do you think about product innovation in terms of VLE? How does it take place?*
4) *Are there any particular market segments targeted by your product?*
5) *Which attributes of VLE are persistently improved over previous upgrades?*
6) *Why are certain product attributes improved persistently? Who initiated and advocated the persistent efforts? What drove these persistent efforts? were certain issues not addressed? Which one?*
7) *What motivate staff to improve those product attributes and how that commitment change over time?*
8) *What were the consequences (positive and negative) of improving the key product attributes? If negative, how did the company address the negative outcomes? What did other competitors do when confronted with the same situation?*
9) *Were there any other benefits/ negative consequences?*
10) *How does the voice of the customer come into the innovation process?*
11) *What is the decision-making process implemented regarding product innovation?*
12) *How are resources allocated to features? How are improvements monitored?*
13) *How will a future VLE look like*
14) *Is there anything more you would like to add and are there other people that you know that could contribute to the study?*

**IV. Closing interview：**

- ✓ Give the participant the opportunity to ask questions.
- ✓ Reconfirm the participant's consent while the tape recorder is still on.
- ✓ Turn off the tape recorder and thank the participant.
- ✓ Clarify any factual errors expressed by participants during the interview.